

1989

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WASHINGTON

**BULLETIN OF WASHINGTON UNIVERSITY
SCHOOL OF MEDICINE**

1989/1990

ST. LOUIS, MISSOURI



COVER: Frank Keeley (left) a senior medical student at Washington University School of Medicine, teaches 10-year-old Alicia Pugh how to prepare her insulin injection. With them is Julio V. Santiago, M.D., Professor of Pediatrics, Associate Professor of Medicine, and Director of the Diabetes Research and Training Center.

Diabetes, which affects four percent of the world's population, including 12 million Americans, is a complex malfunctioning of the body's metabolic system. Few diseases demand such intensive participation, responsibility, and lifelong self-control on the part of the patient and his or her family. Effective patient education and collaboration between the patient and the physician or diabetes educator improve the chances of successfully motivating the patient. At the same time, there is a pressing need to understand what causes the disease. Research continues in the fields of molecular biology, molecular genetics, and immunology as well as clinical and behavioral research to expand the promise for treatment and prevention.

Washington University has been heavily involved in diabetes care, research, and training for more than 60 years and has one of the largest and most compre-

hensive diabetes programs in the world. In 1947, Drs. Carl and Gerti Cori won the Nobel Prize while on the School of Medicine faculty for their contributions to our understanding of carbohydrate metabolism and insulin action. Over the next few decades, five of their Washington University trainees received Nobel Prizes, and more than 40 became heads of basic science and/or clinical divisions at major medical schools throughout the world. Two of their students — Drs. William H. Daughaday and David M. Kipnis — continued their careers at Washington University. Dr. Daughaday, an endocrinologist who directed the endocrine/metabolism division for 35 years, is known for his research on the basic action of hormones. He discovered that growth hormone action is regulated by a class of plasma growth factors called somatomedins, and developed methods for measuring minute amounts

(continued on inside back cover)



The Departments of Surgery and Pathology at Washington University School of Medicine and Barnes Hospital have made, and continue to make, significant contributions in the development of islet cell transplantation. Islet cell transplantation is performed in patients with type 1 diabetes mellitus, an autoimmune disease in which the insulin-producing cells of the pancreas, in the islets of Langerhans, are selectively destroyed, resulting in glucose metabolism abnormalities. In 1967, Paul E. Lacy, M.D., Ph.D. (pictured right in the photograph at left), Robert L. Kroc Professor of Pathology, developed a method of isolating these cells by collagenase digestion. Much of the work of the first 20 years focused on the isolation of islets, since a different method had to be developed for each species. In 1976, David W. Scharp, M.D. (pictured with Dr. Lacy), Associate Professor of Surgery, joined Dr. Lacy and the work progressed into human islet isolation and transplantation. The isolation procedure consists of multiple steps performed in a state-of-the-art laminar flow clean room (pictured above).

***BULLETIN OF
WASHINGTON
UNIVERSITY***

St. Louis, Missouri

***School of Medicine
1989/1990***

WASHINGTON (USPS: 078-340)
SERIES II, VOLUME LXXXVII, NUMBER 6, JULY 17, 1989.
Published once a month in April, June, September,
November and December; two times in July; and three
times in August by Washington University, One Brookings
Drive, St. Louis, MO 63130-4899. Second-class postage paid
at St. Louis, MO. POSTMASTER: Send address changes to
WASHINGTON, Washington University, Campus Box 8059,
660 S. Euclid Ave., St. Louis, MO 63110-1093.

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CALENDAR 1989-90

1989

JUNE

- | | | |
|--------|--------------------|--|
| 5 | Monday | Academic year begins for the Third and Fourth Year Classes. |
| 9 | Friday | Deadline for registration and initial payment of tuition and fees for the Third and Fourth Year Classes. |
| 13, 14 | Tuesday, Wednesday | National Board Examination, Part I. |

JULY

- | | | |
|----|---------|---|
| 4 | Tuesday | Independence Day observance. |
| 14 | Friday | End of Clinical Clerkship Final Examinations, Moore Auditorium. |

AUGUST

- | | | |
|----|-----------|---|
| 16 | Wednesday | Orientation, matriculation, and initial payment of tuition and fees for the First Year Class. |
| 21 | Monday | Academic year begins for the First and Second Year Classes. |
| 25 | Friday | Deadline for registration and initial payment of tuition and fees for the Second Year Class. |
| | | End of Clinical Clerkship Final Examinations, Moore Auditorium. |

SEPTEMBER

- | | | |
|--------|---------------------|--------------------------------------|
| 4 | Monday | Labor Day observance. |
| 6, 7 | Wednesday, Thursday | National Board Examination, Part I. |
| 26, 27 | Tuesday, Wednesday | National Board Examination, Part II. |

OCTOBER

- | | | |
|---|--------|---|
| 6 | Friday | End of Clinical Clerkship Final Examinations, Moore Auditorium. |
|---|--------|---|

NOVEMBER

- | | | |
|----|----------|--|
| 10 | Friday | First trimester ends for the Second Year Class. |
| 13 | Monday | Second trimester begins for the Second Year Class. |
| 17 | Friday | Deadline for payment of the balance of tuition and fees for the Third and Fourth Year Classes. |
| | | End of Clinical Clerkship Final Examinations, Moore Auditorium. |
| 23 | Thursday | Thanksgiving Day observance. |
| 24 | Friday | Holiday for First and Second Year Classes. |

DECEMBER

- | | | |
|----|----------|---|
| 16 | Saturday | Winter recess begins at 1 p.m. for the Second, Third and Fourth Year Classes. |
| 21 | Friday | First semester ends at 5 p.m. for the First Year Class. |

1990

JANUARY

- | | | |
|----|-----------|--|
| 3 | Wednesday | Winter recess ends at 8 a.m. for the Second, Third and Fourth Year Classes. |
| 8 | Monday | Second semester begins at 8 a.m. for the First Year Class. |
| 12 | Friday | End of Clinical Clerkship Final Examinations, Moore Auditorium. |
| 19 | Friday | Deadline for payment of the balance of tuition and fees for the First and Second Year Classes. |

FEBRUARY

- | | | |
|----|--------|---|
| 16 | Friday | Second trimester ends for the Second Year Class. |
| 19 | Monday | Third trimester begins for the Second Year Class. |
| 23 | Friday | End of Clinical Clerkship Final Examinations, Moore Auditorium. |

MARCH

- | | | |
|----|-----------|---|
| 7 | Wednesday | National Board Examination, Part III. |
| 18 | Sunday | Spring recess begins for the First and Second Year Classes. |
| 26 | Monday | Classes resume at 8 a.m. for the First and Second Year Classes. |

APRIL

- | | | |
|---------|-----------------------|---|
| 3,
4 | Tuesday,
Wednesday | National Board Examination, Part II. |
| 6 | Friday | End of Clinical Clerkship Final Examinations, Moore Auditorium. |
| 12 | Thursday | Spring recess begins at 5 p.m. for the Third and Fourth Year Classes. |
| 16 | Monday | Classes resume at 8 a.m. for the Third and Fourth Year Classes. |

MAY

- | | | |
|----|-----------|--|
| 11 | Friday | Third trimester ends for the Second Year Class.

End of Year Clinical Clerkship Final Examination in Medicine, Moore Auditorium. |
| 16 | Wednesday | National Board Examination, Part III. |

- | | | |
|----|----------|--|
| 17 | Thursday | Academic year ends at 5 p.m. for graduating students. |
| 18 | Friday | Commencement.

End of Clinical Clerkship Final Examinations, Moore Auditorium.

Academic year ends for the Third Year Class. |
| 25 | Friday | Second semester ends for the First Year Class. |

JUNE

- | | | |
|-----------|-----------------------|-------------------------------------|
| 12,
13 | Tuesday,
Wednesday | National Board Examination, Part I. |
|-----------|-----------------------|-------------------------------------|

CLERKSHIP AND SIX-WEEK ELECTIVE PERIODS

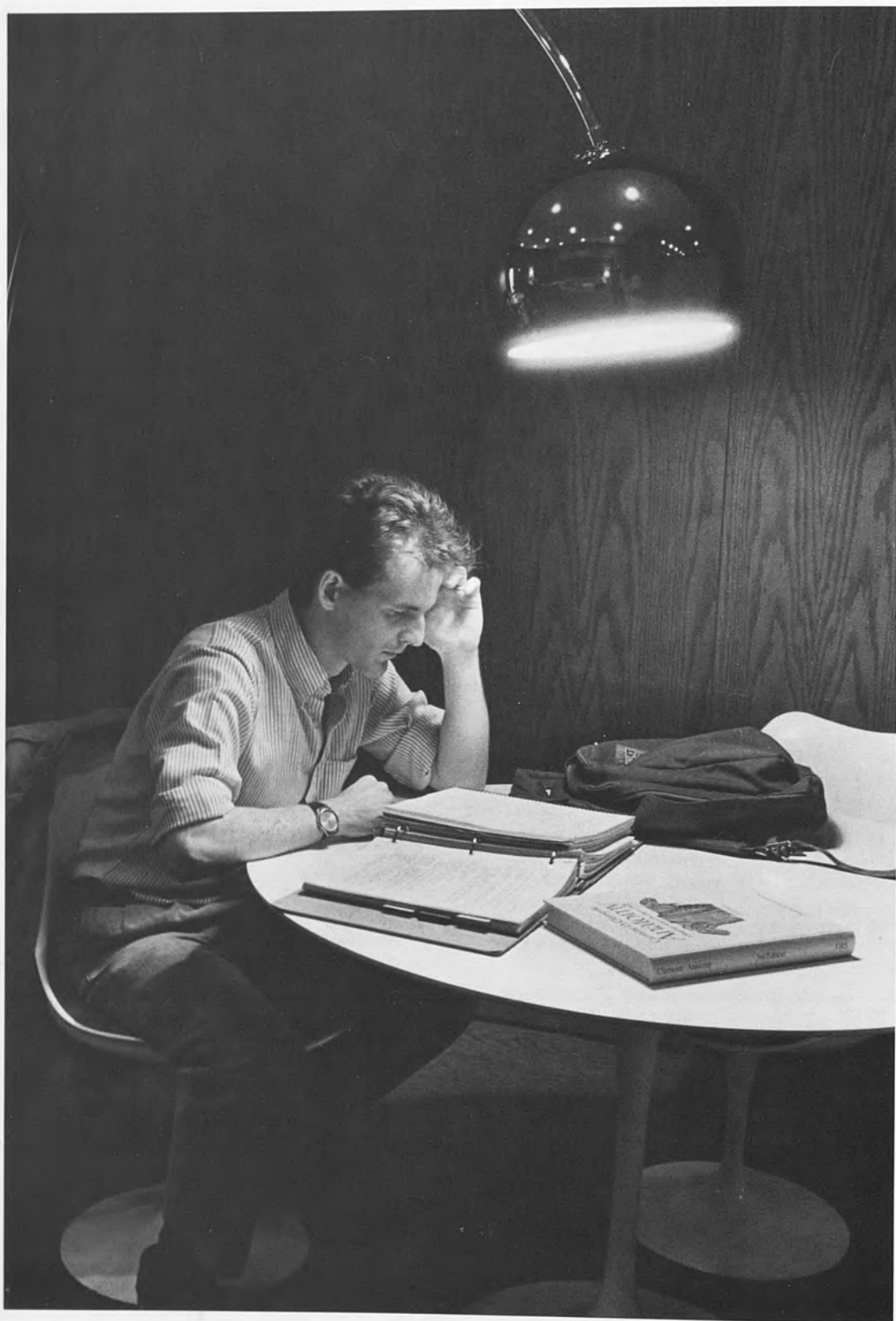
Period Begins

- | | |
|------|-------------------|
| I | June 5, 1989 |
| II | July 17, 1989 |
| III | August 28, 1989 |
| IV | October 9, 1989 |
| V | November 20, 1989 |
| VI | January 15, 1990 |
| VII | February 26, 1990 |
| VIII | April 9, 1990 |

FOUR-WEEK ELECTIVE PERIODS

Period Begins

- | | |
|---|--------------------|
| A | June 5, 1989 |
| B | July 3, 1989 |
| C | July 31, 1989 |
| D | August 28, 1989 |
| E | September 25, 1989 |
| F | October 23, 1989 |
| G | November 20, 1989 |
| H | January 3, 1990 |
| I | January 29, 1990 |
| J | February 26, 1990 |
| K | March 26, 1990 |
| L | April 23, 1990 |



THE STUDY OF MEDICINE AT WASHINGTON UNIVERSITY

The Washington University School of Medicine has one of the richest traditions of any medical school in the country. In the early 1900s it provided the leadership in shaping the system of clinical instruction provided by American medical schools, and today it remains one of the foremost institutions of medical education and research in the world.

The School of Medicine was formed in 1899 by the union of the first two medical schools established west of the Mississippi River: the Missouri Medical College and the St. Louis Medical College. When the two were united as the Medical Department of Washington University, they combined their strengths, offering the finest medical instruction in the Midwest.

In 1910, the School formed a relationship with Barnes Hospital, which was in the planning stages, and the existing St. Louis Children's Hospital to allow students into the wards as clinical clerks. It also gave the School the opportunity to conduct clinical research and to appoint staff members of both hospitals. Until that time, no American medical school except Johns Hopkins conducted its clinical work in this fashion.

Washington University's program was immediately successful and emulated by other medical schools throughout the country, thus ushering in the modern era of American clinical education. William Welch, the first dean of The Johns Hopkins School of Medicine, declared that Washington University's new program "marks the second epoch in medical education in the United States, as Hopkins marked the first."

The reorganization of the clinical teaching was accompanied by a restructuring of the rest of the School's program in 1910. With the help of funds provided by the General Education Board and by St. Louis philanthropists and civic leaders Robert Brookings, William Bixby, Adolphus Busch, and Edward Mallinckrodt, the School built a new campus and appointed a faculty of internationally distinguished medical scientists. Among the features adopted by the reorganized School were: full-time teaching appointments, enlarged hospital and outpatient facilities, laboratory space for both preclinical and clinical departments, faculty time for research, and a teaching program which allowed undergraduate, graduate, and postgraduate students to have meaningful contact with eminent faculty members in informal small group settings. These tenets have resulted in bringing together a faculty, staff, and alumni who have been awarded many honors, appointments, and elections to important professional offices. Fifteen Nobel laureates have been associated with the School of Medicine, and 21 have been elected to the National Academy of Sciences. Many more are members of advisory boards of foundations and governmental granting agencies.

Today, the Washington University School of Medicine continues as one of the premier medical schools in the world. It excels at both the scientific and research bases of medicine and the application of that knowledge to patient care and clinical practice.

Information on the history of the Washington University School of Medicine written by Kenneth M. Ludmerer, M.D. Dr. Ludmerer is the author of *Learning to Heal: The Development of American Medical Education* (New York: Basic Books, 1985).

HISTORICAL PERSPECTIVE

Washington University School of Medicine's tradition of excellence includes its research in the basic and clinical sciences. Some examples: Evarts A. Graham, M.D., former head of the School's Department of Surgery, pioneered the use of chest surgery for patients suffering from chronic tuberculosis, and was the first surgeon to remove an entire affected lung to treat cancer (the patient subsequently lived 30 years). During the latter half of the 1920s, Dr. Graham developed a method of visualizing the gallbladder by x-ray, which opened the door for successful gallbladder surgery.

The first electron microscope used in the United States for biological research was constructed at the School of Medicine in 1935. During the same decade, researchers at the School's Mallinckrodt Institute of Radiology developed laminography, a method for imaging in slices that became the forerunner of computed tomography (CT scans), and was one of the first to receive a CT body scanner. Other "firsts" at Mallinckrodt: the use of hyperthermia in the treatment of cancer, and the development of PET (positron emission tomography), an imaging process that uses markers to picture the metabolism of the heart, brain, and other organs.

Under the care of Washington University physicians, patients at Barnes Hospital were among the first to receive insulin for diabetes. Today, Washington University Medical Center has the largest and most comprehensive program in the world for diabetes basic research, public and patient education, clinical training, and research and patient care. In October 1986 the School of Medicine was awarded an eight-year grant totaling more than \$2.5 million to determine whether highly intensive forms of diabetes treatment can prevent or stop the progression of early eye, kidney, and nerve damage that occurs commonly in patients with insulin-dependent diabetes. The School of Medicine also leads in cancer research and in the study of heart disease. It is in the forefront of treatment and research to prevent the loss of vision and to restore sight.

Washington University School of Medicine is consistently ranked among the top 10 medical schools in the country in funding from the National Institutes of Health (NIH). In fiscal 1988, the School of Medicine ranked sixth out of 124 medical schools, with total NIH support for research and training of over \$82 million. NIH support went for studies ranging from Alzheimer's disease, diabetes and cardiovascular diseases to nerve growth factor, brain imaging and blood clotting factors.

Of the several hundred research programs currently active at the School of Medicine, 26 are NIH Program Project and Center Grants. Characteristically large and long-term, program project grants are awarded through an extremely competitive process that selects a recipient from the ranks of the best researchers, research programs or facilities nationwide.



Program Project and Center Grants for 1987-88, with total support of nearly \$26.5 million, are:

- A Resource of Biomedical Mass Spectrometry
- Alzheimer's Disease Research Center
- Basic Mechanisms of Seizure
- Computer-Aided Drug Design
- Cyclotron Produced Isotopes in Biology Medicine
- Diabetes Research and Training Center
- Eicosanoid Synthesis, Function and Regulation
- Epidemiological Genetics and Family Study
- Gastrointestinal Proteins Cell and Molecular Regulation
- General Clinical Research Center
- Healthy Aging and Senile Dementia
- Inner Ear Fluid Dynamics in Health and Disease
- Interdisciplinary Research Center in Immunologic Diseases
- Interdisciplinary Stroke Program
- Neurobiology, Genetics, Epidemiology and Alcoholism
- Pathophysiology of Renal Disease and Uremia
- Physiological Adaptations to Exercise in the Elderly
- Program in Medical Mycology
- Program Project in the Pathophysiology of Human Growth
- Program Project in Transplantation Biology
- Regeneration and Functional Recovery in Neural Tissue
- Senator Jacob Javits Center of Excellence in Neuroscience

Specialized Center of Research in Thrombosis
Studies of Neuronal Structure as Related to
Function
Study of Ischemic Heart Disease
Washington University Center for Vision Research

The School of Medicine has established three new research centers -- building on existing programs -- to study AIDS, genetics and molecular biology.

The AIDS Clinical Trials Group will receive \$5.5 million in NIH funding over five years to develop better AIDS treatment methods, conduct basic and clinical research, and improve public and physician education. The Center -- one of 17 nationally -- includes a set of core laboratories with the latest diagnostic and prognostic techniques for evaluating AIDS patients and involves researchers from a variety of disciplines.

The Center for Genetics in Medicine, established through a \$1.8 million grant from the James S. McDonnell Foundation, will take part in one of the most challenging projects in the biomedical sciences: complete analysis of the human genome. Work will be based on techniques developed at the School of Medicine to clone and then purify much larger unique fragments of human DNA than was previously possible. In addition, a special collaboration with RIKEN, Japan's Institute of Physical and Chemical Research, permits access to that Institute's advanced DNA sequencing facility.

Through a five-year, \$12.1 million grant from the Lucille P. Markey Charitable Trust of Miami, the School of Medicine will establish the Markey Center for Research on the Molecular Biology of Human Disease. The Center will support collaborative, interdisciplinary research projects in five principal areas: molecular basis of the immune response, structure and function of animal cells, molecular pharmacology, molecular genetics, and protein structure and function.

Organ transplantation -- and research to develop surgical techniques and anti-rejection therapies -- has become a strength of Washington University School of Medicine and Barnes Hospital, its largest teaching affiliate. The cardiac transplantation program, initiated in 1985, was approved for Medicare coverage, a designation by which the federal government recognizes the high quality of the program. In addition to the cardiac program, the School of Medicine and Barnes Hospital have a long-standing commitment to the transplantation of other organs and tissues, including kidney, liver, heart-lung, cornea, bone marrow, long bones and pancreatic islets.

FACULTY

The Washington University School of Medicine has one of the finest faculties of any medical school in the nation. Recognized for their distinguished achievements in original research, 21 faculty members are in the National Academy of Sciences. In addi-

tion, 15 Nobel laureates have been associated with the School of Medicine. During 1988-89, 42 members of the faculty held individual or career development awards from the National Institutes of Health and 16 held awards from the American Heart Association. The School of Medicine has 13 faculty members with Method to Extend Research in Time (MERIT) status, a special recognition given to only a few NIH grantees, which provides long-term, uninterrupted financial support to investigators who have demonstrated superior achievement during previous research projects.

In 1988-89, the School employed 869 full-time, salaried faculty members in its 17 preclinical and clinical departments. The clinical departments are further strengthened by 981 part-time faculty members, a group of physicians who practice their medical specialties in St. Louis and are members of one or more of the staffs of the four hospitals in the Washington University Medical Center.

STUDENTS

The School of Medicine attracts a student body of exceptional quality. The 1988 Entering Class of 120 students was selected from a pool of 3,462 applicants. More than 94 percent of the applicants accepted to the School had one or more acceptances at other U.S. medical schools. The School is a national institution with 43 states, the District of Columbia, and four foreign countries represented in the current enrollment.

In 1989, the School conferred the M.D. degree upon 103 individuals. In addition, four students received the M.A./M.D. degrees and 16 students graduated with the combined M.D./Ph.D. degree. Graduating students who participated in the 1989 National Residency Matching Program matched one of their top three choices in 87 percent of cases, with 60 percent obtaining their first choice of residency in programs recognized for high quality and selectivity.

The student body of the School of Medicine numbers 537 medical students. Programs are also conducted for 342 students who are pursuing degrees in health administration, occupational therapy, nurse anesthesia, physical therapy, and radiologic technology. The Division of Biology and Biomedical Sciences has extensive graduate training programs for 212 students seeking the Doctor of Philosophy degree in areas of cell biology, evolutionary and population biology, molecular biology: genetics and biochemistry, immunology, neural sciences, and plant biology.

PHILOSOPHY

The efforts of the School of Medicine are directed toward providing able students with a stimulating and challenging milieu in which they may acquire a thorough background in scientific medicine, as well as a deep understanding of the meaning of com-

prehensive medical care. In a field that is developing as rapidly as is medicine, education begun in medical school must serve as the foundation for a lifelong course of learning. As Sir William Osler pointed out some decades ago, a faculty, no matter how talented, can "only instill principles, put the student in the right path, give him methods, teach him how to study, and early to discern between essentials and nonessentials."

Students today are preparing to cope with a changing world and to contribute, in a constructive, considered way, to resolving the problems of medicine and of health care. To assist in that preparation, the faculty's mission is to preserve the joy of learning and to foster a spirit of discrimination and creativity. It is hoped that all students will achieve this grounding during their years in the School of Medicine.

In summary, the Washington University School of Medicine and the institutions in the Washington University Medical Center are committed to providing patients with high-quality medical care in a concerned, compassionate way, to increasing medical knowledge through research, and to educating superbly qualified young men and women in the health professions.

FACILITIES

The Washington University Medical Center, spread over portions of six city blocks, is located along the eastern edge of Forest Park in St. Louis. Along the western edge of the park is the Hilltop Campus of the University. A regularly scheduled shuttle bus, operated for the benefit of students, faculty and staff, brings the two campuses within 10 minutes of each other.

The Medical Center was incorporated in 1962. It now consists of the Washington University School of Medicine, Barnes Hospital, Jewish Hospital, St. Louis Children's Hospital, Barnard Hospital, the Washington University School of Dental Medicine, and the Central Institute for the Deaf. Integral units of the Medical Center include the world-famous Mallinckrodt Institute of Radiology, the Institute for Biomedical Computing, and the Irene Walter Johnson Institute of Rehabilitation.

The last five years have been a period of unprecedented expansion for the School of Medicine. Expenditures for renovations and new construction projects have exceeded \$113 million, while work space has increased by 63 percent. This expansion includes the new Medical Library and Biomedical Communications Center, the three-tower, 10-story Clinical Sciences Research Building (CSRB) and the East Building. With the construction has come a network of pedestrian bridges that interconnect the CSRB, East Building, and Barnes, Jewish, and Children's hospitals with the rest of the Medical Center. This ability to move freely among facilities enhances the interaction of all Medical Center institutions, greatly benefitting

research and patient care.

The new Medical Library and Biomedical Communications Center will be completed in the fall of 1989. This \$14 million structure, consisting of 113,000 gross square feet, will, along with significant expansion of its programs, be able to provide for long-term growth in its collections and even more importantly, provide state-of-the-art information management. The School of Medicine is divided into two segments. The clinical departments are on the west side of the Medical Center, adjacent to hospital and patient areas, while the preclinical departments are to the east. Research and instructional activities occupy the greater portion of the facilities, with more than 1.6 million gross square feet. In the aggregate, the School now occupies nearly 2.9 million gross square feet of space.

The focal point of the preclinical teaching facilities is the McDonnell Medical Sciences Building, center of activity for entering medical students. The McDonnell Building, with 300,000 square feet of first-class research laboratories and classroom space, was made possible by James Smith McDonnell III, a generous benefactor of Washington University. Rising nine floors above-ground, it contains administrative offices and two lecture halls on the first floor. Multidisciplinary teaching laboratories for first- and second-year students, and offices and research laboratories for the seven basic science departments and the Division of Biology and Biomedical Sciences are located on the upper floors. Modern centralized animal quarters are housed in the basement. In addition, two floors (15,467 gross square feet) of Olin Residence Hall have been converted into student carrels, classrooms and conference rooms.

The North and South Buildings, in which centered the work of several Nobel laureates, have been extensively renovated. Along with the Cancer Research Building, they continue to provide space for laboratories, offices, and some departmental facilities. The East Building houses an MRI (magnetic resonance imaging) facility containing a 20 kilogauss magnet, as well as a film library, computer installation and other components of the Mallinckrodt Institute of Radiology. Other facilities in the East Building include the Program in Physical Therapy, the medical and dental bookstore, and several administrative office suites.

The clinical departments of the School of Medicine, housed in nine buildings, are connected by a pedestrian bridge to the preclinical facilities. Washington University medical students receive intensive clinical training, and the School's clinical program is acknowledged as one of the best programs in the country. Over a five-year period (1983-1987), the Medical Center had more than 2.7 million days of care for patients in and outside the St. Louis area, and there were more than one million clinic and emergency room visits. In 1987, there were 1,767 operating beds among the Barnard, Barnes, Jewish, and St.

Louis Children's hospitals. In addition, students may take clinical training at the St. Louis Regional Medical Center and Cochran Veterans Administration Hospital; both are served by full-time and part-time faculty members of the School of Medicine.

Medical students work with patients in all areas of clinical care. This "hands-on" approach for clinical training, one-on-one with some of the top clinical faculty in the world, in a large, state-of-the-art medical center, makes the training at Washington University School of Medicine a vigorous and challenging experience.

The following facilities are owned and operated by Washington University.

William Greenleaf Eliot Division of Child Psychiatry, located in St. Louis Children's Hospital, conducts an advanced teaching program in child psychiatry and is the focus for research and treatment in child psychiatry.

Irene Walter Johnson Institute of Rehabilitation is a center for training personnel in rehabilitation procedures, for treatment of disabled persons in the St. Louis metropolitan area, and for research related to chronic diseases.

Oscar Johnson Institute for Medical Research occupies the top five floors of the McMillan Hospital.

McMillan Hospital houses offices and research laboratories for the Departments of Neurology and Neurological Surgery, Ophthalmology and Visual Sciences, and Otolaryngology.

Edward Mallinckrodt Institute of Radiology—An internationally recognized center of excellence in teaching, research, and clinical services in Radiology, the Institute is housed in a 10-story building with satellite units in the West Pavilion of Barnes Hospital, the East Building, and St. Louis Children's Hospital. MIR's facilities include two functioning cyclotrons and a 5 kilogauss Nuclear Magnetic Resonance unit.

Renard Hospital—With consolidation of Psychiatric patient-care services in the West Pavilion, this recently renovated eight-story structure provides additional office and laboratory space for the Department of Psychiatry.

St. Louis Maternity Hospital houses offices and research laboratories for the Departments of Obstetrics and Gynecology, Ophthalmology and Visual Sciences, and Otolaryngology. A new Perinatal Center and laboratories for research in the physiology of reproduction are located in this building.

West Building contains offices and research laboratories for the Department of Internal Medicine, as well as for the Department of Pathology.

David P. Wohl, Jr., Memorial Hospital (ten floors), opened in 1953, provides offices and laboratories for the Departments of Medicine and Surgery. Recently completed were facilities for a Cancer Center on floor three which is contiguous with companion facilities in the adjacent Barnard Hospital.



David P. Wohl, Jr., Memorial-Washington University Clinics are administered by Barnes Hospital and handle over 100,000 outpatient visits a year. Five floors of the building are devoted to the clinics and five floors to research facilities for several departments of the School of Medicine. This building is owned by the School of Medicine, with Barnes Hospital operating the recently expanded Emergency Room and the David P. Wohl, Jr. Memorial—Washington University Outpatient Clinics.

Clinical Sciences Research Building

The Clinical Sciences Research Building, consisting of 382,080 gross square feet of space, is the newest research facility at the Medical Center. The 10-story structure, constructed at a cost of \$55 million, houses research laboratories for the School's clinical departments, the Howard Hughes Institute, and contemporary animal care facilities.

Further, the Clinical Sciences Research Building is the connecting link for a series of enclosed pedestrian bridges that tie the Medical Center together. These enclosed, environmentally-controlled bridges connect Jewish Hospital on the north, the new Children's Hospital on the west, and the Wohl Buildings and Barnes Hospital to the south.

Institute for Biomedical Computing

The Institute for Biomedical Computing is an inter-school facility which spans computing research activities at both the School of Medicine and the School of Engineering and Applied Science. The Institute consists of two research-laboratory components, the Biomedical Computer Laboratory and the Computer Systems Laboratory, both of which have close ties with both Schools. The purpose of the Institute is to foster the development and application of advanced computing and engineering technologies to problems in biomedical science. In addition to its activities in collaborative research, the Institute serves as a focal point for interdisciplinary teaching and student research in areas not ordinarily included in conventional curricula.

The Institute has its primary location on the campus of the School of Medicine, but it also occupies the Edward L. Bowles Laboratory on the Engineering School campus. The Bowles Laboratory is adjacent to Computer Science, Electrical Engineering, and other departments of the School of Engineering. This provides an Engineering School location for research and teaching activities associated with the Biomedical Computer Laboratory and the Computer Systems Laboratory. The arrangement creates opportunities for collaborations between the two campuses and fosters involvement of students in activities spanning the medical and computer-engineering disciplines.

Medical Library and Biomedical Communications Center

Founded in 1911, the Washington University School of Medicine Library is one of the oldest and largest medical libraries in the Midcontinental Region. It serves as an information center for the faculty, students, and staff of the Medical Center and, in addition, extends its services and resources to health professionals in the local, state, and national communities.

In the fall of 1989, the School's new Library and Biomedical Communications Center will be completed. This state-of-the-art building integrates four components: a modern health sciences library, an audiovisual production and service complex, a computer teaching and information management laboratory, and a health information network that links regional, national, and international information resources. The eight-level, 113,000 square-foot structure will house over 450,000 volumes and is one of the most technologically advanced health sciences libraries in America.

The Center maintains a comprehensive collection of over 212,000 volumes and some 3,200 current subscriptions. An Audiovisual Library makes available to users some 1,500 audiovisual titles. Its History of Medicine Division includes such outstanding collections as the Bernard Becker Collection in Ophthalmology, the Goldstein Collection in Speech and

Hearing, and the Paracelsus Collection of the St. Louis Metropolitan Medical Society. It houses the Archives of the Medical Center which includes records and private papers of the School, memorabilia, and oral histories of individuals who have made important contributions to American medicine. Among its manuscript collections are papers of William Beaumont, Joseph Erlanger, E. V. Cowdry, Evarts Graham, and Carl Cori.

The Center is a pioneer in technology application, and users will find most functions computerized. Through its BACS database, students and staff may access from their offices a variety of information sources, among them, the Library's catalog of book and journal holdings, *Current Contents*, and MEDLINE. The world's output of knowledge is reached through online access to over 250 computerized data bases covering the biological, health, social and physical sciences. As a member of the large regional and national networks, the Center reaches other library collections nationwide through telecommunications.

Library hours are 8 a.m. to 12 midnight on weekdays; 8:30 a.m. to 6 p.m. on Saturdays; and 1 p.m. to 10 p.m. on Sundays. Holiday hours are posted when applicable.

For information on the Library's special services, the "Library Guide," "Library Newsletter," or Information Services (362-7085) may be consulted.

The Medical Center

The School of Medicine is part of a medical center of 1,767 operating beds and over 15,000 employees, providing over 493,000 days of care and more than 232,000 ambulatory care visits each year. Organized formally in 1962, the umbrella organization now known as the Washington University Medical Center consists of a strong confederation of private institutions committed to the pursuit of excellence in health care, teaching, and research. Students receive clinical instruction and gain experience in all divisions of the Medical Center.

Over the years, with the growing confidence of working together, the Washington University Medical Center has undertaken increasingly complex projects. Evidence of this is the massive redevelopment project under way in the 36-block area surrounding the Medical Center. Working closely with the neighborhood, the Washington University Medical Center Redevelopment Corporation has, over a 13-year period, provided impetus for new office buildings, laboratories, apartment buildings, commercial areas, renovated single dwellings, and many public improvements. To date, nearly \$450 million worth of construction, renovation, and improvements have been completed or commissioned, with new construction by Medical Center institutions accounting for about 80 percent of this total. This program began its second 10-year phase in 1986.



Barnes Hospital is the largest hospital in the Medical Center. It is independently owned and, through special agreement, operates outpatient clinics in buildings owned by the University. The contiguous facilities provide a major source of clinical experience for medical students. Barnes Hospital is licensed for approximately 1,200 beds (operating 1,032) and includes teaching facilities for all clinical departments except Pediatrics. All activities of the School of Medicine and Barnes Hospital are closely integrated, and the hospital staff is composed exclusively of members of the faculty of Washington University School of Medicine.

The 18-story Queeny Tower has five nursing floors and two self-care floors, plus five floors of doctors' offices. The addition of four floors to the East Pavilion and a companion structure, the 18-story West Pavilion, has resulted in a facility that houses over 730 patient-care beds, over 50 operating rooms, a chronic renal dialysis unit, a 110-seat amphitheatre, doctors' offices, and additional facilities for the Mallinckrodt Institute of Radiology.

The combined East-West Pavilion, jointly owned by Barnes Hospital and the University, is one of the largest, most sophisticated tertiary medical facilities in the world. A large central diagnostic laboratory provides modern diagnostic patient services.

Barnard Free Skin and Cancer Hospital is independently owned but is operated by Barnes Hospital. It is a 44-bed hospital for the care and treatment of patients who suffer from skin diseases and cancer or who are undergoing special tests in the Clinical Research Center.

St. Louis Children's Hospital, governed by its own Board since 1879, is an integral part of the Medical Center and is nationally recognized as a premier provider of advanced care for neonates, children and

adolescents. A completely new 235-bed, 500,000 square-foot facility was dedicated in April 1984. Children's offers the full range of primary, secondary, and tertiary pediatric care. The hospital is recognized as a major referral and research center for a variety of diseases including neurological and communicative disorders, childhood diabetes, kidney and vascular diseases, craniofacial deformities and birth defects, and pediatric infectious diseases. The professional staff of Children's Hospital are members of the faculty of the School of Medicine.

Jewish Hospital, an acute and tertiary care facility licensed for 628 beds and operating 500, is a charter member and integral component of the Washington University Medical Center. It serves as a primary teaching hospital for the School of Medicine, providing education for medical students throughout their clinical experience, as well as training for graduate physicians in many specialties and subspecialties. The hospital provides an array of health-oriented services, an alcohol and chemical dependency program, including stress management, *in vitro* fertilization, a broadly based consultative service for the elderly (Program on Aging), an osteoporosis diagnosis and prevention center, and an inpatient and ambulant rehabilitation program.

Its modern nine-story Sydney M. Shoenberg Pavilion provides 300 inpatient rooms, four intensive care units, 16 operating suites, as well as diagnostic radiology and clinical laboratories. Jewish Hospital is also one of the largest research institutions in the state of Missouri, housing and sponsoring many major investigative programs in its Yalem Research Building and in the adjacent Washington University Clinical Sciences Research Building.

Central Institute for the Deaf, an internationally known institution, provides facilities for research into

hearing problems, maintains a school for deaf and speech-handicapped children, provides outpatient clinics for children and adults, and engages in a program of professional education for scholars in the fields of audiology, otolaryngology, and education of the deaf.

In addition to the above facilities which make up the Washington University Medical Center, the following are affiliated with the School of Medicine, and various members of the staffs hold University appointments.

St. Louis Regional Medical Center—St. Louis City and St. Louis County, with 300 beds.

Malcolm Bliss Mental Health Center, with 150 beds.

Ellis Fischel State Cancer Hospital, Columbia, Missouri, with 110 beds.

St. Louis Veterans Administration Hospitals, with 614 authorized beds.

St. Louis Shriners Hospitals for Crippled Children, with 80 beds.

The Washington University School of Dental Medicine operates walk-in clinics, where third- and fourth-year students practice dental procedures. The school is aggressive in treating children's dental problems. Dental faculty operate several clinics, including one for maxillofacial prosthodontics, the rebuilding of jaws and other facial structures left abnormal by birth defects, or surgery to remove disease. Another clinic is in Children's Hospital, for both inpatients and outpatients. A residency training program in oral and maxillofacial surgery is conducted at Barnes Hospital.

CURRICULUM

The curriculum is the product of prolonged and continuing study, by both faculty and students, of the present and probable future course of medical science and medical practice, and of the ways in which medical education can be kept abreast of this course. It is planned to provide students who enter medical school with diverse backgrounds and interests and who will undertake a wide variety of careers, with the basic knowledge and skills essential for their further professional development. Modern medical education can no longer hope to be comprehensive; it must be selective. Yet students must develop facility in the understanding and use of several related technical languages: those of anatomy, chemistry, physiology, and clinical medicine. They must share responsibility for the care of the patient. They must also learn how these areas of endeavor are interrelated, how the organization and needs of society influence the methods of providing medical care, and how new knowledge is acquired and old knowledge reevaluated.

The curriculum includes a core experience based upon a sequence of courses that will introduce students to the broad panorama of medicine. The principles, the methods of investigation, the problems,



and the opportunities in each of the major disciplines of medical science and medical practice are presented in such a way as to help students select the career best suited to their abilities and goals.

The elective program helps students to decide where their major interests lie. It also enables them to benefit from the wide range of specialized knowledge and skills found in the faculty. As there is not enough time for all students to be introduced to each of today's areas of specialization, the elective program permits them to select, according to their own desires, the areas they wish to explore or to study in depth.

Table of Required Hours 1989-90

As reported to the Liaison Committee on Medical Education, representing the Council on Medical Education of the American Medical Association and the Executive Council of the Association of American Medical Colleges, credit hours for courses are expressed in terms of clock hours—the scheduled hours per year of actual lecture and laboratory contact between faculty and students. These clock hours are not to be interpreted as semester or quarter hours.

First-year courses are taught during the 36-week academic year.

A revised First Year curriculum will be implemented for the 1989-90 academic year. The plan and scope of the new curriculum is unavailable at the time of preparation of this issue of the *Bulletin*.

Second-year courses are taught during the 36-week academic year.

<i>Clock Hours</i>	<i>Courses</i>
	Introduction to Clinical Medicine
124	Physical Diagnosis Core
7	Ophthalmology
7	Otolaryngology
10	Human Sexuality
41	Psychiatry
28	Radiology
13	Surgery
7	Rheumatology
17	Neurology and Neurosurgery
16	Developmental Biology (Peds)
7	Medical Sociology
5	Medical Ethics
245	Pathology
149	Pharmacology
	Pathophysiology ***
20	PP Cardiovascular
15	PP Pulmonary
19	PP Renal
27	PP Metabolism-Endocrinology
24	PP Gastro Intestinal
28	PP Hematology
12	PP Oncology
19	PP Neuropathophysiology
24	PP Developmental Biology (Ob/Gyn)
8	PP Nutrition
30	PP Infectious Diseases
902	Total clock hours for the year

Clinical Clerkship (Third) Year is a 48-week academic year.

<i>Clock Hours</i>	<i>Courses</i>
462	Medicine Clerkship
154	Neurology/Neurosurgery Clerkship
231	Obstetrics/Gynecology Clerkship
38.5	Ophthalmology Clerkship
38.5	Otolaryngology Clerkship
231	Pediatrics Clerkship
231	Psychiatry Clerkship
462	Surgery Clerkship
1,848	Total clock hours for the year

*** Pathophysiology of Infectious Diseases will be integrated among Pathology, Pharmacology, Pathophysiology, and Introduction to Clinical Medicine.

Elective (Fourth) Year is a 48-week academic year.

To qualify for the Doctor of Medicine degree at Washington University School of Medicine, fourth-year students are required to participate in a minimum of 36 weeks of electives (full-time clinical or research courses). Two-thirds of the minimum required time for the Elective Year must be taken exclusively in residence in the Washington University School of Medicine elective course program. A complete listing of fourth-year elective offerings at Washington University School of Medicine is available through the Office of the Associate Dean for Curriculum. Students may participate in clinical electives of four and six weeks duration. If a student takes a research elective, that elective must be of at least 12 weeks duration.

A maximum of 12 weeks' credit is allowed for full-time elective course work taken at other academic institutions. These may be clinical or research electives. Students desiring credit for work to be done at other institutions must petition the Associate Dean for Curriculum and the standing subcommittee of the Committee on Academic Review and Promotions (CARP-III) for approval of the plan of study. Absolutely no credit will be granted for electives undertaken prior to subcommittee approval.

Credit may be given for elective work done at any point in the standard four-year Doctor of Medicine degree program so long as participation conforms to current elective guidelines and (a) the student is a duly registered, full-time student for a minimum of three years and nine months, including scheduled vacation time, and tuition is paid for four complete academic years; or (b) if transferring into the Second Year Class, the student is a duly registered, full-time student for a minimum of two years and nine months and tuition is paid for three complete academic years; or (c) if transferring into the Third Year Class, the student is a duly registered, full-time student for a minimum of 22 months and tuition is paid for two complete academic years.

Students are encouraged to take lecture-seminar elective courses, but such offerings are optional.

Total clock hours for the year 1,386

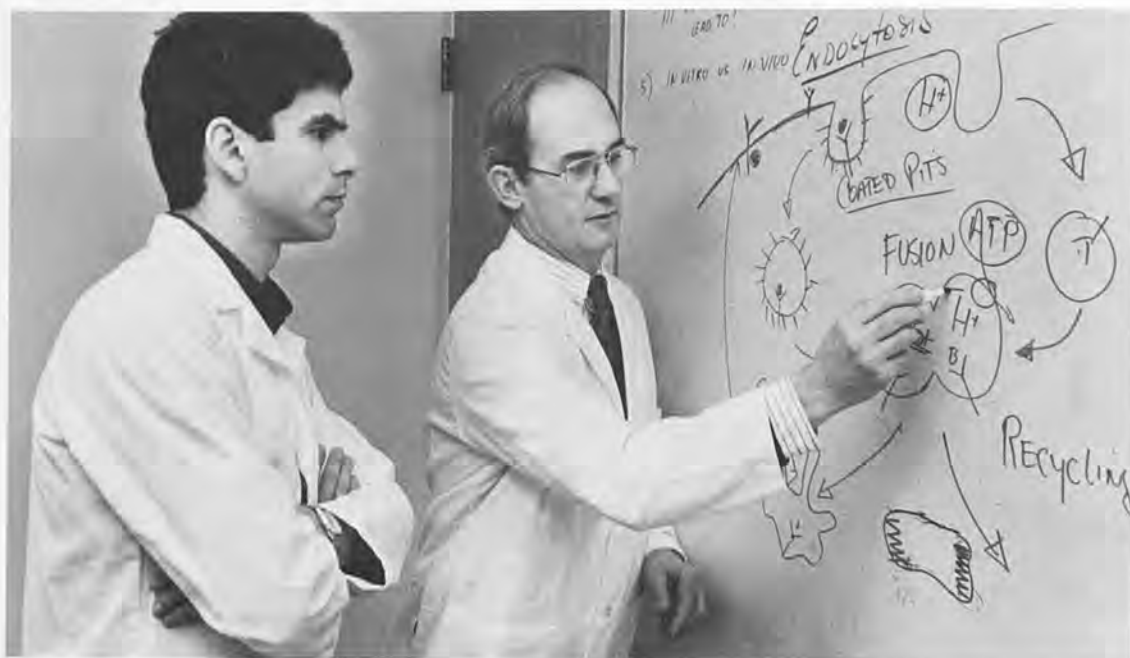
Remuneration for work done while participating in electives for credit is *prohibited*.

DEGREE PROGRAMS

The Washington University School of Medicine offers four programs leading to the M.D. degree: a regular four-year program, a five-year program, the M.A./M.D. program, and a combined M.D./Ph.D. program.

Doctor of Medicine, Four-Year Program

By conferring the M.D. degree, the University certifies that the student is competent to undertake a career as a doctor of medicine. It certifies further that,



in addition to medical knowledge and skills, the graduate possesses qualities of personality—compassion, emotional stability, and a responsible attitude—essential to an effective professional life.

A course of medical education for the M.D. degree ordinarily consists of a minimum of four years of study. Students recommended for the degree Doctor of Medicine must be of good moral character, they must have completed an entire academic course of instruction as matriculated medical students, they must have passed all required subjects or the equivalent and have received satisfactory grades in the work of the full academic course, and they must have discharged all current indebtedness to the University. Individuals applying for licensure must be at least 21 years of age.

At the end of the final academic year, students who have fulfilled these requirements will be eligible for the M.D. degree.

Five-Year Program

In addition to the regular four-year program leading to the M.D. degree and the M.A./M.D. degree program, students are permitted to spend one additional year in an academic program in a medical or medically-related field. The program must be arranged with an academic advisor and is subject to the approval of the Committee on Medical Education.

M.A./M.D. Program

Medical students who are interested in an intensive research experience may apply for admission to the M.A./M.D. Program after the first, second or third year of medical school. Students spend one year

(12 months) working in the laboratory of the faculty member whom they have selected. Application to the program consists primarily of a student-prepared proposal for a significant and feasible project defined with the advice of the faculty mentor. The program requires submission of a thesis in the form of a publication-quality manuscript at the end of the year of research. Students completing the program will be awarded a Master of Arts degree at the time that the M.D. degree is conferred. Students accepted into this program qualify for a stipend during the research year. Additional information can be obtained from the Office of the Medical Scientist Training Program.

M.D./Ph.D. Medical Scientist Training Program (MSTP)

Washington University offers a combined M.D./Ph.D. program that utilizes the resources of the Division of Biology and Biomedical Sciences and the School of Medicine. This Program, the Medical Scientist Training Program, is designed for students interested in careers in academic medicine. Its purpose is to provide the basic research training needed for careers at major medical schools and research institutions. The Program was started in 1969, is one of the oldest and largest in the country, and is currently authorized to accept 20 students per year. The Program, which is usually completed in six years, has been highly successful; more than 90 percent of those who have completed their residencies are actively involved in research programs at leading institutions.

All students in the Program receive financial support in the form of stipends (currently \$10,500 per year) and tuition remission.

Only students who have spent an equivalent of at least one semester in a research laboratory should apply to the Medical Scientist Training Program. Applicants must meet the requirements for admission to both the School of Medicine and the Graduate School of Arts and Sciences although the Graduate Record Examination is not required. In addition, students planning to concentrate in disciplines related to the chemical or physical sciences should have completed mathematics through calculus, physics and physical chemistry, and advanced organic chemistry. A course in differential equations is also recommended. For those students whose major interests are in the more biological aspects of medical science, the requirements for chemistry are less rigorous, but a strong background in mathematics and physics is important. Although most individuals enter the Program as first-year students, applications will be accepted from students in their first or second year at this medical school.

The Program consists of three parts: (1) Two years of the usual medical curriculum; (2) At least three years of original research toward a thesis to satisfy the requirements for the Ph.D. degree; (3) A final year which is the usual clinical year of the medical curriculum and is adjusted to each student's career goals. Since the fourth year at Washington University School of Medicine is entirely elective, the medical scientist will have taken the equivalent of that year during the graduate portion of the Medical Scientist Training Program. Students normally take the first two years of the usual medical curriculum before entering the graduate portion of the Program, but it is possible to begin research following completion of the first year of the regular medical curriculum. Either sequence will satisfy requirements for both the M.D. and Ph.D. degrees. Degrees are awarded upon completion of the entire program.

While the Medical Scientist Training Program includes all medical courses required for the M.D. degree, it incorporates a high degree of flexibility for individuals through a wide range of electives and graduate courses as well as the large number of thesis programs available. Every effort is made to individualize each student's curriculum based on previous background and current interests. A student can be excused, by examination, from any of the regularly offered preclinical courses and may substitute either advanced coursework or laboratory research in the time made available. In this way, students may have an opportunity to carry out supervised research during the first two years. The members of the Medical Scientist Training Program Committee are available to students to help them decide on an individual curriculum and appropriate laboratory rotations.

The performance of each student is reviewed annually and a high scholastic standing as well as a commitment to research is expected.

Funding support begins when the student begins the Program, either on July 1 or at the beginning of the medical school year. Students are encouraged to begin the Program in July. For these students, the first week is spent visiting faculty in various departments and choosing a laboratory in which to carry out a short research project before beginning medical school classes.

Students in the combined degree program will complete the usual medical school courses in the first two years. They are expected to do a summer research project between the first and second years of medical school. The laboratories selected for summer research need not be those chosen for the Ph.D. portion of the Program.

Students will spend the third, fourth and fifth years satisfying the following requirements of the Graduate School of Arts and Sciences for the Ph.D. degree:

- 1) Completion of graduate coursework;
- 2) Successful performance in qualifying examinations;
- 3) Execution of original research suitable for a dissertation;
- 4) Defense of the thesis.

Students are also required to carry out a one-semester teaching assistantship during this period.

The Ph.D. degree may be obtained in any of the programs of the Division of Biology and Biomedical Sciences that includes the Departments of Anatomy and Neurobiology, Biochemistry and Molecular Biophysics, Biology, Cell Biology and Physiology, Genetics, Molecular Microbiology, Pathology, and Pharmacology. These departments jointly provide training in the following interdisciplinary programs:

- Cell Biology;
- Evolutionary and Population Biology;
- Immunology;
- Molecular Biology: Genetics and Biochemistry;
- Neural Sciences.

These programs draw together faculty from all of the departments listed above and provide maximum flexibility for student training.

A series of monthly seminars are held for M.D./Ph.D. students that are conducted by medical scientists of the clinical departments. These seminars are aimed at stimulating student interest in clinical medicine and at increasing awareness of major research problems in clinical medicine.

A special tutorial for M.D./Ph.D. students facilitates their transition into the sixth year of the program, which is the clinical year of the normal medical curriculum. The intensive clinical training provided in the final year is the last formal requirement for the M.D. degree. Both the Ph.D. and M.D. degrees will be granted at the conclusion of this clinical year.

Application Procedure

Students interested in applying to the Medical Scientist Training Program must apply to Washington

University School of Medicine, which participates in the American Medical College Application Service (AMCAS). Those who have applied to the medical school and have not received information regarding this program may request an application or obtain additional information by writing to:

*Ms. Barbara J. Fox, Assistant Director
Medical Scientist Training Program
Campus Box 8033
Washington University School of Medicine
660 South Euclid Avenue
St. Louis, Missouri 63110
Telephone: (314) 362-7190*

Doctor of Philosophy Programs

The Division of Biology and Biomedical Sciences offers predoctoral programs in Cell Biology, Evolutionary and Population Biology, Molecular Biology: Genetics and Biochemistry, Immunology, Neural Sciences, and Plant Biology. These educational activities are organized on an interdepartmental basis by the faculty of the seven preclinical departments of the School of Medicine, as well as the Department of Biology in the School of Arts and Sciences. All degrees are awarded through the Washington University Graduate School of Arts and Sciences. Additional information about the Divisional programs may be obtained by writing to:

*The Office of Graduate Affairs
Campus Box 8072
Washington University School of Medicine
660 South Euclid Avenue
St. Louis, Missouri 63110*

APPLYING FOR ADMISSION

Washington University encourages application from and gives full consideration to applicants for admission and financial aid without respect to sex, race, handicap, color, creed, or national or ethnic origin. University policies and programs are nondiscriminatory. The School of Medicine is committed to recruiting, enrolling, and educating an increased number of students from racial minority and educationally deprived groups.

Preparation for the Study of Medicine

Entrance requirements to the School of Medicine are:

1. Evidence of superior intellectual ability and scholastic achievement;
2. Completion of at least 90 semester hours of college courses in an approved college or university;
3. Completion of the Medical College Admission Test of the Association of American Medical Colleges;
4. Evidence of character, attitude, interests, and motivation suitable for a career in medicine.

Chemistry, physics, and mathematics provide the tools for modern biology, for medicine, and for the

biological basis of patient care. Thus, a firm grounding in these subjects is essential for the study of medical sciences. Entering students are expected to have had at least the equivalent of one-year courses at the undergraduate level in physics and biology; to have studied mathematics through integral calculus; and to have a background in chemistry, including organic chemistry. In selected instances, one or more of these prerequisites may be waived by the Committee on Admissions, but applicants are strongly advised to pursue their interests in these and in other areas of science.

A major goal of undergraduate college work should be development of the intellectual talents of the individual. This often involves the pursuit of some area of knowledge in depth, whether in the humanities, social sciences, or natural sciences. At the same time, a diversity of background is encouraged in order to provide a necessary foundation for cultural development. Specific courses, other than the few in the natural sciences, are not presented as prerequisites because a great variety of courses may prepare students for the many roles they may play in their medical careers.

Application Procedure

The Washington University School of Medicine participates in the American Medical College Application Service (AMCAS) of the Association of American Medical Colleges. AMCAS provides a centralized system for applying to any participating medical school with only one application and one set of official transcripts of academic work.

The AMCAS Application for Admission, common to all participating medical schools, is distributed by the AMCAS and preprofessional advisors. Applicants are urged to file their applications as early as possible.

Applicants to the 1990 First Year Class must submit their AMCAS application so that it is postmarked no later than November 1, 1989. On receipt of the application from AMCAS, the Office of Admissions promptly forwards to applicants the additional materials that must be submitted to complete the application process. At this stage, a nonrefundable Application Service Fee of \$45 is charged by the University. Once complete, the applicant's admission credentials are reviewed and independently evaluated by members of the Committee on Admissions. The Committee would like to interview every applicant, however, since this would involve several thousand applicants, it is physically impossible to accomplish. Therefore, selected applicants are invited for a personal interview, as well as a tour of the School of Medicine and the Washington University Medical Center. This visit provides an opportunity for the applicant to meet and talk with students and faculty members.

If an applicant is planning an interview trip which will include the St. Louis area, it is appropriate to

write the Interview-Appointments Secretary, Committee on Admission, Box 8107, Washington University School of Medicine, 660 South Euclid Avenue, St. Louis, Missouri 63110, to inquire if an interview has been authorized. The inquiry should be made at least three weeks in advance of the anticipated travel. The Office of Admissions is open weekdays from 8:30 a.m. to 5 p.m. central time.

Admission decisions are made by the 20-member faculty Committee on Admissions. Washington University School of Medicine operates on a rolling admissions schedule beginning October 15, and applicants are notified as soon as a final admission decision has been made on their application. By May 15, 1990, every applicant should have a final decision: accepted, waiting list, or not accepted.

Upon notification of acceptance for admission to the School, the applicant is required to file a Statement of Intent. Three options are presented: 1) accept the offer of admission and submit the \$100 acceptance deposit; 2) accept the offer of admission, submit the \$100 deposit, and request financial aid materials; and 3) decline the offer of admission. The \$100 acceptance deposit reserves a place in the class and is applied to the tuition charge at the time of matriculation. If an accepted applicant withdraws from the class with written notification to the Admissions Office prior to May 16, 1990, the deposit is refunded.

Full Tuition Scholarships

In 1978, the School of Medicine established a scholarship program which based selection on merit rather than financial need. As one of the first merit scholarship programs for medical students, the Disting-

guished Student Scholarship Program has recognized and rewarded academic excellence and personal achievement for over ten years.

To recognize outstanding alumni of Washington University, the Medical Center Alumni Association created in 1989 the Distinguished Alumni Scholarship Program. For the 1989-90 academic year, the first scholarships are named to honor Eugene M. Bricker, M.D., Alexis F. Hartmann, M.D., Carl V. Moore, M.D., and Mildred Trotter, Ph.D.

Distinguished Student Scholarships

Five full-tuition scholarships are awarded annually to members of the entering First Year Class. In early fall 1989, selected applicants for admission to the School's 1990 First Year Class will be invited to file applications for scholarship consideration. Selection will be made by a committee of the faculty and will be based on demonstrated superior intellectual achievement as well as an assessment of the applicant's character, attitude, motivation and maturity. The announcement of the 1990-91 scholarship recipients will be made on April 3, 1990.

Distinguished Alumni Scholarships

Four full-tuition scholarships are awarded annually to members of the entering First Year Class. The application procedure and selection process is the same as the above description for the Distinguished Student Scholarships.

Both the Distinguished Alumni Scholarships and the Distinguished Student Scholarships are subject to annual renewal. Recipients of these scholarships are expected to maintain academic excellence. If a scholarship is not renewed, the student may file for



financial aid from the School. For scholarship recipients who document financial need above the full-tuition scholarship, additional funds are available to provide support up to the total cost of education. Scholarship recipients may not concurrently participate in the School's Medical Scientist Training Program or the Armed Forces Health Professions Scholarship Program.

Third Year Class Transfer Program

Each year the Washington University School of Medicine accepts 8 to 12 transfer students into its Third Year Class. This class enlargement is permitted because of the abundant clinical training facilities available in the Medical Center and because of the existence of a national need for such transfer positions. Transfer applications are accepted from well-qualified students who are enrolled in good standing and eligible to continue in their U.S. medical schools, who have a cogent reason for requesting transfer, and who have the full approval of the dean of their current school.

Transfer application forms for our 1990 Third Year Class are available on August 1, 1989. Application deadline is November 1, 1989. Those applicants selected for interview will be invited to visit the Medical Center during November 1989. All applicants will be notified of the decision of the Committee on Admissions by December 31, 1989. Inquiries should be directed to:

*Third Year Class Transfer Program
Washington University School of Medicine
660 South Euclid Avenue—Campus Box 8077
St. Louis, Missouri 63110*

FINANCIAL INFORMATION

Cost of Education

For a first-year matriculant, tuition and housing rates for the 1989-90 academic year are listed below. Although the University reserves the right to change the fees at any time without notice, any change will not become effective until the 1990-91 academic year. Other items listed provide an estimate of the expenses for a single student in the 36-week, First Year Class. The total of these figures suggests a basic minimum budget of approximately \$20,266. Allowances for entertainment, travel, clothing, and other miscellaneous items must be added to this estimate.

Tuition (includes Student Health Service and Microscope Lending Plan)	\$14,100
Books, supplies, and instruments	1,206
Housing (single room, Olin Residence Hall)	2,050
Board (Medical Center cafeterias)	2,910

Student Health Service

The Student Health Service provides comprehensive health care, including hospitalization, for all students in the School of Medicine. Health insurance coverage for dependents of students can be arranged.

Microscope Lending Plan

Microscopes which meet the technical requirements set by the faculty are provided at no additional charge to each student in the First and Second Year Classes. The Plan saves students the high cost of microscope purchase and makes available to them a superior quality instrument.

Registration, Payment of Financial Obligations, and Refunds

All tuition and fee payments are due and payable on the dates specified in the published calendars of the programs in the School of Medicine. Failure of a student to register on or before the date specified in the published calendar will result in a late registration fee of \$50, to be added to the amount due. Any tuition and fee payments due from the student and not paid at the time of registration or on the specified due date accrue interest at the lesser of: (a) the rate of one percent above the prime interest rate in effect on the first business day of the month in which that payment is due, or (b) the maximum lawful interest rate then in effect. Any amounts not paid when due plus accrued interest thereon must be paid in full within three months of the original due date. If a student fails to settle such unpaid amounts within three months of the original due date, the School of Medicine will not release the student's academic record or progress reports pending settlement of the unpaid account. A student who has not satisfied all past due financial obligations to the University one month before the end of the academic year will not be allowed to progress to the next academic year or graduate.

A student who withdraws from the School will receive a pro rata refund of tuition and appropriate fees. The refund will be based on the ratio of the class days enrolled (from the first day of classes to the termination date) to the total number of class days in the term for which tuition and fees were paid. It is understood that the date on which a student formally notifies the Registrar's Office in writing of the decision to withdraw from the School of Medicine shall be regarded as the termination date, with no retroactive clause to be accepted. A prospective date will be accepted, however. If tuition and fees were paid entirely or in part by financial aid from the School, the refund will be applied first to the total repayment of the accounts from which financial aid was drawn, with any remaining refund balance given to the student. Financial aid received in excess of the costs of tuition and fees must be refunded by the student to the School on the same pro rata basis as calculated for the tuition refund outlined above.



Financial Assistance

The ability to finance a medical education at Washington University does not influence the student selection process. As all students accepted for admission have proven scholastic ability, financial assistance is awarded solely on the basis of documented financial need which cannot be met by student and family resources. Students who consider themselves financially independent of their parents must arrange for loans to replace the amount of support parents are analyzed to have the potential to contribute. The School of Medicine's Office of Financial Aid (Box 8059) will assist students in making these arrangements.

At the time accepted students indicate they will matriculate in the School of Medicine, they may request an application for financial aid. The Financial Statement and other financial aid materials, information, and instructions will be sent to the students by return mail. The Financial Statement solicits information about the applicant and parents, including a detailed description of resources and liabilities. In addition, it requests information about the income, expenses, education, and employment history of the student's spouse (or spouse-to-be). The School asks that the statement be completed promptly, within two weeks from date of receipt.

Financial aid award decisions are made by the five-member Committee on Student Financial Aid, and applicants are notified of the award decision within two weeks of the date the processed Financial Statement is received. Official copies of the parents' and the applicant's U.S. individual income tax returns complete the data required for financial aid consideration. All information is held in strict confidence.

Financial aid awards are credited toward payment of tuition and fees. Proceeds from loans may be disbursed directly to the borrower. The loan portion of an award will be funded through the resources of the School of Medicine or through the Stafford Loan program (formerly the Guaranteed Student Loan program). All loans awarded by the Committee are free of interest while a student is enrolled in the School. Financial aid awards are made for a given academic year. Students may reapply for financial assistance in succeeding years if they remain in good academic and personal standing, and if there is continued financial need. Awards made to a student may vary from year to year, depending upon the student's needs and upon the availability of funds to the Committee. Students are responsible for filing applications for renewal of awards in the spring of each year.

The Committee holds that students receiving assistance have an obligation to notify the Committee in writing if their financial situation changes, for example, through employment or receipt of a scholarship not anticipated at the time the application was submitted.

First- and second-year students are urged not to accept employment during the academic year. A number of fourth-year students find employment in hospitals within the Medical Center. The Personnel Office provides assistance to students' spouses seeking employment.

Policy For International Students

The admission decision at Washington University School of Medicine is based on academic and personal merit and not on the ability of the student to pay the costs of education. However, individuals

who are not citizens of the United States of America or who do not hold U.S. Permanent Resident Visa status are not eligible for financial aid due, in part, to regulations covering most programs used by the School to fund financial assistance. Therefore, in order for the School to complete the required documents which are necessary for issuance of a Visa, the student must document, by a date and in a manner designated by the School, that the necessary amount of funds, as established by the School, is available to pay the costs of education (tuition and living expenses) for the anticipated period of enrollment, normally four years.

Documentation of the required amount of financial resources may be by a letter of credit or by deposit of funds in an escrow account with a bank designated by the School. In either manner, the funds must be available only to the School. Should the amount prove inadequate to cover the necessary costs, an additional letter of credit or deposit to the escrow account will be required. Unused funds will be released upon the student's termination, withdrawal, or graduation from the School.

Standards for Satisfactory Academic Progress for Financial Aid Eligibility

Federal law and regulations require that all students receiving financial assistance from Federal Title IV funds maintain satisfactory academic progress. The following policy presents the standards adopted by the Washington University School of Medicine. The policy applies to all students receiving financial aid.

Academic requirements for the M.D. degree include the satisfactory completion of the curriculum designated by the faculty. The progress of each student working toward an M.D. degree is monitored carefully and at least once each academic year by the designated Committee on Academic Review and Promotions. The qualitative measure of performance is based on a Pass/Fail grading system for the first semester of the first year, and thereafter on an Honors/High Pass/Pass/Fail/Incomplete and Deferred grading system. A student who does not satisfactorily complete all course requirements may be permitted to remediate. In this case, a student assigned to an individualized program which deviates from the norm and who earns satisfactory qualitative assessment in all courses for which enrolled will be deemed to be making satisfactory academic progress. The individualized program permits a student to take one final makeup re-examination in a course which a student has failed.

The normal time frame for completion of required course work for the M.D. degree is four academic years. Due to academic difficulties or personal reasons a student may require additional time. In such situations, the Committee on Academic Review and Promotions may establish a schedule for that student which departs from the norm. To be considered to be making satisfactory academic progress, the stu-

dent must complete the first two years of the curriculum by the end of the third year after initial enrollment. The Committees on Academic Review and Promotions will monitor the progress of each student at the conclusion of each academic year to determine that the student is making sufficient progress to meet the time limits as specified. A student not making sufficient progress will be deemed not to be making satisfactory academic progress.

A student may be granted a leave of absence for health reasons or personal reasons. The period of time for which the student has been granted a leave of absence shall be excluded from the maximum time frame expected for completion of the program.

Medical students who are accepted for transfer from other medical schools will be evaluated with respect to levels of academic progress attained and a determination will be made as to remaining years of financial aid eligibility. This determination will be coordinated among the Assistant Dean in Academic Administration, Associate Dean for Student Affairs, and the Director of Student Financial Aid.

A student failing to meet one or more of the standards of progress shall be placed on financial aid probation. While on probation the student may receive financial assistance for one trimester, semester or equivalent time period. At the conclusion of this period, the student must have achieved compliance with each standard.

A student who does not achieve compliance with each standard by the conclusion of the probationary period is suspended from financial aid eligibility.

The Office of Student Financial Aid must notify a student of implementation of probationary status and/or suspension.

A student shall be reinstated for financial aid eligibility at such time as that student has completed satisfactorily sufficient course work to meet the standards of progress. A student on financial aid probation or suspension may appeal that status by indicating in writing to the Director of Student Financial Aid the existence of mitigating circumstances which should result in reinstatement of financial aid eligibility. Each appeal will be considered on its merit by the Committee on Student Financial Aid.

The Director of Student Financial Aid shall have primary responsibility for enforcement of this policy. The Director shall provide in writing to each student at the time of initial enrollment a copy of this policy. The Director shall ascertain at the time of each disbursement of funds and prior to certification of a financial aid application that the student is in compliance with the policy.

Scholarship Funds

Helen M. Aff-Drum Scholarship Fund. Established in 1988 to provide scholarship support to financially deserving medical students.

American Medical Association Education and Research Foundation Scholarships. Established to provide need-based student financial aid.

Dr. William Monroe Baker Fund. Established in 1988 under the will of Miss Lola Braxton in memory of Dr. Baker to provide scholarship assistance to worthy students who would be otherwise unable to obtain a medical education.

The Barnes Hospital Society Scholarships. Established in 1989 by the attending staff physicians of Barnes Hospital, one scholarship is awarded to a first-year student based on financial need, four book scholarships are awarded to first-year students based on financial need, and an additional four book scholarships are awarded to second-year students who demonstrated distinguished academic achievement in the first-year curriculum.

Dr. William Joseph A. and Helene H. Bauer Scholarship Fund. Created in 1987 by Dr. and Mrs. Joseph A. Bauer to provide scholarship support to academically well-qualified and financially deserving medical students.

Albert G. Blanke, Jr. Endowed Scholarship Fund. Established by a generous gift in 1982, the fund provides scholarship assistance for deserving students in the School of Medicine.

Gilbert L. Chamberlain, M.D., Scholarship Fund. Created in 1971 by Dr. Gilbert L. Chamberlain to be used to aid worthy students in acquiring their medical education.

Cecil M. Charles--Nu Sigma Nu Medical Student Scholarship Fund. Established by the Nu Sigma Nu Medical Fraternity in memory of Dr. Charles.

Grace Strong Coburn Scholarship Fund. Created in 1962 through the bequest of Mrs. Grace Strong Coburn for scholarships in the School of Medicine.

T. Griswold Comstock Scholarships. Established under the will of Marilla E. Comstock for students who would otherwise be unable to obtain a medical education.

Dr. Charles Drabkin Scholarship Fund. Created in 1964 to provide financial assistance to medical students.

Robert Elman Scholarship in Surgery. Created in 1980 through the bequest of Minna Elman in memory of her husband.

Carl Fisch Scholarship Fund. Created in memory of Dr. Fisch by his daughter, Marguerite F. Blackmer. Provides support to students who demonstrate financial need.

George F. Gill Scholarship Fund. Instituted in memory of a former clinical professor of pediatrics.

Harvielle-Bailey Scholarship. Established in 1970 under the will of Miss Isabel Bailey Harvielle as a memorial to Dr. Charles Poplin Harvielle and Dr. Steele Bailey, Jr., alumni of the School.

Dr. Grace Huse Memorial Fund. Provides scholarship awards for deserving Washington University medical students.

Insurance Medical Scientist Scholarship Fund. Established for the training of promising scholars intent upon a career in research and academic medicine.

Jackson Johnson Scholarship Fund. Provided through a bequest in 1930 from Jackson Johnson.

Dr. Lorraine A. Johnsrud Scholarship Fund. Established in 1983 as a memorial to Lorraine from her classmates, friends, and family to assist deserving medical students in the funding of their medical expenses.

Henry J. Kaiser Family Foundation--Medical Century Club Scholarship Fund. Following the Foundation's generous gift in 1980 for medical student scholarships, the Medical Century Club accepted the challenge to raise new scholarship funds to match an additional gift from the Foundation.

George D. Kettelkamp Scholarship Fund. Established in 1969 by Mrs. Kettelkamp in memory of her husband, an alumnus of the School of Medicine.

Albert F. Koetter, M.D., Scholarship Fund. Established in 1978 by Mrs. Stella Koetter Darrow in memory of her father, an alumnus and former faculty member of the School of Medicine. At least one full-tuition scholarship is awarded annually on the basis of academic achievement and financial need.

Anne L. Lehmann Scholarship Fund. Established in 1983 to grant continued scholarship support to medical students.

Maude L. Lindsey Memorial Scholarships. Created in 1976 to assist students in the School of Medicine.

John R. Lionberger, Jr., Medical Scholarship Endowment Fund. Created in 1982 by Dr. John R. Lionberger to be used to aid worthy students in acquiring their medical education.





Eliza McMillan Scholarship Fund. Provides assistance to young women in any of several schools of the University to secure an education.

Alma Mavis Scholarship Fund. Created in 1988 under the will of Alma Mavis to assist students intending to practice family (general) medicine.

Medical Center Alumni Scholarship Fund. Awarded on the basis of academic achievement and financial need.

Roy B. and Viola Miller Memorial Fund. Created in 1963 through the bequest of Roy B. Miller to provide scholarships for medical students and for post-graduate students engaged in study and research in the medical sciences.

The Warren S. and Dorothy J. Miller Scholarship Fund. Established in 1982 through the bequest of Dorothy J. Miller to provide scholarships for any students engaged in studies leading to the degree of Doctor of Medicine and especially for those students with an aptitude and desire for the general practice in internal medicine.

Minority Medical Students Scholarship Fund. Instituted by minority graduates of the School of Medicine and supported by them, other alumni, faculty and friends, this fund provides two \$5,000 scholarships to first-year minority medical students. One scholarship is awarded based upon academic accomplishment from the premedical school record. The second scholarship is awarded based upon financial need. Selection of recipients will be made by the Minority Medical Students Scholarship Fund Committee.

Joseph J. and Ernesta G. Mira Scholarship Fund. Established in 1988 by Dr. and Mrs. Mira to provide assistance to students from the Alton, Illinois area, including the counties of Madison, Jersey, Calhoun, Greene and Macoupin.

Mr. and Mrs. Spencer T. Olin Fellowships for Women. Provides for annual financial support to women in any of several disciplines. Application deadline is February 1.

Spencer T. and Ann W. Olin Medical Fellowships. Created in an effort to help fill the continuing shortage of physicians who pursue careers in biomedical research, the awards are primarily for students in the six-year Medical Scientist Training Program (a program that trains students simultaneously as physicians and researchers and that grants a combined M.D./ Ph.D. degree). Olin Medical Fellowships also are awarded to selected students pursuing doctoral degrees in biomedical science.

William B. Parker Scholarship Fund. Established in 1976 by the School of Medicine in honor of William B. Parker's fifty-one years of service to the School.

The George M. (M.D. '32) and George K. (M.D. '64) Powell Medical Student Scholarship Fund. Established in 1984 by Mrs. George M. Powell in grateful appreciation for the medical education provided to her husband and son by the Washington University School of Medicine, which so positively affected the lives of the Powell Families.

Henry and Louise Reller Scholarship. To be given to medical students in the name of the parents of Louise Reller.

Samuel Jennings Roberts Scholarship Fund. Created to provide scholarships for any students engaged in study leading to the degree of Doctor of Medicine.

Robert Allen Roblee Scholarship Fund. Established in 1948 through the gift of Mrs. Joseph H. Roblee for students in the School of Medicine.

Thomas W. and Elizabeth J. Rucker Scholarship Fund. Created in 1956 under the will of Eugenia I. Rucker, in memory of her mother and father.

J. Max Rukes Scholarship Fund. Established in 1987, the fund provides scholarship support to deserving medical school students who have done research in endocrinology or the chemistry of metabolism.

Joseph H. Scharf Scholarship Fund. Provided in 1949 through the bequest of Dr. Joseph H. Scharf.

School of Medicine Scholarship Fund. Created in 1970 to provide financial assistance for medical students.

Dr. John B. Shapleigh Scholarship Fund. Established in 1926 with the bequest of Dr. John B. Shapleigh and supplemented by contributions from Mrs. Shapleigh and Miss Margaret Shapleigh.

Alexander Balridge Shaw Scholarship Fund. Created in 1958 through the bequest of Roy A. Shaw in memory of his father, Dr. Alexander Balridge Shaw.

Dr. Edward Hiroshi Shigeoka Scholarship Fund. Created in 1988 by Dorothy F. Shigeoka in memory of her husband, Dr. Edward Hiroshi Shigeoka, to help disadvantaged and deserving students pursue their careers in medicine.

Ernie Simms Scholarship Fund. Founded in 1984 by friends, colleagues, and former students of Professor Simms in recognition of his contributions to scholarly research and teaching in the Department of Microbiology and Immunology.

Beulah B. Strickling Scholarship Fund. Established in 1960 with a bequest from Mrs. Beulah B. Strickling.

Marleah Hammond Strominger Scholarship. Established in 1971 by the family and friends of Marleah Hammond Strominger. The recipient shall be a motivated student with need for financial assistance and shall come from a disadvantaged background.

Mary and Ernst Stuehrke Scholarship Fund. Established in 1987, to assist medical students with documented financial need.

Edwin H. and Virginia M. Terrill Scholarship Fund. Established in 1964 with the bequest of Dr. Edwin H. Terrill, an alumnus. It was Dr. Terrill's hope that scholarship recipients would repay into the Fund the amount of the award.

Mildred Trotter Scholarship Fund. For students with documented financial need, the fund was established in 1979 by Dr. and Mrs. Paul Guttman, and supplemented by former students of Dr. Trotter, as a tribute to her many years of teaching in the Department of Anatomy.

Hiromu Tsuchiya Scholarship Fund. Created to provide scholarships in the School of Medicine.

Tubolske-Jonas-Tubolske Medical Scholarship Fund. Established in 1974 by Rose T. Jonas in memory of her father, husband, and brother. The recipient shall be a senior student preparing to enter the field of surgery, obstetrics and gynecology, or internal medicine.

Dr. Cornelia M. Van Prooyen Scholarship Fund. Established in 1987, the fund provides scholarship support and other financial assistance to female medical students.

Louis H. Waltke and Marie Waltke Memorial Fund for Medical Education. Created in 1984 to provide scholarships and fellowships at the School of Medicine.

Dr. George S. Wilson Scholarship Fund. Established in 1988 with the bequest of Dr. George S. Wilson to provide scholarship support to medical students.

Scholarship and Loan Funds

Isabel Valle Brookings Scholarship and Loan Fund. Established in 1957 by Isabel Valle Brookings (Mrs. Robert S.) for scholarships and loans in the School of Medicine.

Arpad Csapo, M.D., Memorial Scholarship and Loan Fund. Established in 1982 by Elise Csapo in memory of her husband, and by his friends and colleagues to provide assistance for students who have shown promise in fields relating to reproductive medicine.

Danforth Foundation Loan and Scholarship Fund. Provides financial assistance for medical students.

Danforth Medical Foundation Fund. Created through gifts from the Danforth Foundation and the late William H. Danforth to furnish loans, scholarships, or outright grants to talented and promising young men and women engaged in study or research in basic medical or clinical sciences.

Paul H. and Lila L. Guttman Student Aid Fund. Established in 1976 to provide financial assistance to qualified medical students.

Robert Wood Johnson Foundation Fund. Created in 1972 to provide financial assistance for students who are from rural backgrounds, members of specified minority groups, and women.

Phi Beta Pi-Charles Ruggieri Scholarship/Loan Fund. Established in 1985 by the Washington University Alumni of the Phi Beta Pi medical fraternity to honor Charles Ruggieri and to assist deserving medical students enrolled in the Washington University School of Medicine with the funding of their undergraduate medical education.

William H. and Ella M. Schewe Fund. Established to provide financial assistance to worthy students in the medical school.

School of Medicine Loan and Scholarship Fund. Created in 1970 to provide financial assistance for medical students.

Wilkinson Scholarship Fund. Created in 1968 by the bequest of Anna J. Wilkinson in honor of her husband, Dr. George E. Wilkinson. Medical and postdoctoral students are eligible for Wilkinson scholarships or loans.

Loan Funds

American Medical Association Loan Program. Makes available bank loans without collateral to eligible medical students, interns, or residents who are citizens of the United States. Applications for such loans are made through the Education and Research Foundation of the American Medical Association.

Ruth Elizabeth Calkins Scholarship Loan Fund. Established by Dr. Delevan Calkins in honor of his granddaughter.

Jess K. Goldberg Memorial Loan Fund by Ophelia H. Kooden and Violet G. Sachs. Created in 1970 to provide loans for medical students in memory of the donors' brother who passed away while attending medical school.

Health Professions Student Loan Fund. Established by federal legislation for medical students with a demonstrated financial need. Loans are available for long terms at favorable rates.

Ursula Hecker Loan Fund. Established in 1967 by a bequest from Ursula Lee Hecker for the use and benefit of worthy, deserving, and needy medical students.

Robert Wood Johnson Foundation Student Loan Guarantee Program. Provides "a last-resort source of funds for educational expenses."

W. K. Kellogg Foundation Loan Fund. Provides financial assistance to medical students in need of such aid.

Gustel and Edith H. Kiewitt Scholarship Loan Fund. Provides loan funds for medical students.

Medical Scholars Loan Program. Established in 1985 by members of the William Greenleaf Eliot Society, this fund provides an interest-free source of long-term student loans. Annual contributions from alumni and friends support this perpetual and growing resource upon which current and future medical students will draw.

George W. Merck Memorial Loan Fund. Established in 1959 by The Merck Company Foundation, the original purpose of the loan was modified in 1983 to provide loans to graduating students which would help bridge the transition from student to resident physician.

Perkins Student Loan. A federal program (formerly National Direct Student Loan) to provide loans to students with financial need. Permits repayment over an extended period at a favorable interest rate.

Dr. William C. and Elva Pratt Loan Fund. Established in 1982 for medical students with demonstrated financial need.

G. H. Reinhardt Memorial Scholarship Loan Fund. Established in 1947 through the bequest of G. H. Reinhardt.

Aline Rixman Loan Fund. Created in 1940 by William Rixman in memory of his wife, the fund is used to alleviate unexpected financial emergencies of medical students.

Caroline O. Schlesinger Loan Fund. Established in 1969 to provide financial support for medical students.

School of Medicine Student Loan Fund. Established to make loans to students with documented financial needs.

Washington University Medical Center Alumni Association Loan Fund. Provides emergency loans to medical students.

ASSESSING ACADEMIC ACHIEVEMENT

To assist students in evaluating their progress, each is graded in every course by the faculty. In the clinical and elective years, grades are accompanied by detailed descriptive comments characterizing each student's performance. This type of evaluative data is of considerable assistance to the student applying for internship or residency training, since it permits the Associate Dean for Postgraduate Training to give each hospital to which the student has applied a meaningful, comprehensive summary of the candidate's attributes, abilities, and performance.



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At the conclusion of each academic year every student receives a grade report that indicates achievement in each course taken. When all the official grades have been received, the official transcript, in addition to listing courses and grades achieved, gives the grade distribution in each course.

Grades are:

- H = Honors
- HP = High Pass
- P = Pass
- F = Fail
- DF = Deferred
- I = Incomplete

"Honors" is given for a truly outstanding performance, "High Pass" for very good work, and "Pass" for satisfactory work. "Fail" signifies clearly unsatisfactory performance. "Deferred" indicates a marginal performance with some deficiency that must be removed, and "Incomplete" denotes that course work has not been completed.

If a departmental coursemaster submits a grade of "Incomplete," "Deferred," or "Fail" for a medical student duly enrolled in any medical school course, the coursemaster will include an accompanying statement which contains the following information:

1. Student's name
2. Course title
3. Inclusive dates of course
4. Grade
5. Description of extent of academic encumbrance
6. Remedial action recommended to remove the academic encumbrance.

This type of statement will be submitted to the Office of the Registrar at the time student grades are reported and prior to the scheduled meetings of the various committees on academic review and promotions.

The grade of "F" or "DF" remains permanently recorded on the official academic record/transcript. The final grade reflecting a level of success in the course appears as an additional line entry on the record/transcript.

Tutorials and Individualized Programs

The educational program is designed to meet the needs of all medical students in an individual and a personalized way. To help students who may be having academic difficulty, individual tutorials are offered. The School's experience is that tutorials enable students to handle course work with improved proficiency. Students who are found to have difficulties in handling the normal academic course load will be asked to take an individualized program which would require five rather than four years to complete.

Rules Governing Promotions

A faculty Committee on Academic Review and Promotions reviews the records of all students by curriculum level.

Students must pass all required courses unless excused from their courses by the responsible departments. Students must have satisfactorily completed all the required courses for the first two years in order to proceed to the third year of the curriculum.

Each student's performance will be evaluated periodically by a faculty Committee on Academic Review and Promotions. One such committee (CARP-I) is concerned with the first year, another (CARP-II) with the second year, and a third (CARP-III) with the clinical years of the curriculum. In the case of unsatisfactory progress, as evidenced by failing grades or an inability to develop adequate clinical expertise, the appropriate committee may require that the student be re-examined or repeat the relevant courses. If a student does not achieve or maintain a satisfactory level of scholarship, the committee may drop the student from the School. Any action to drop a student from the School will be the result of a determination by a CARP committee (on the basis of the student's performance and on the judgment of the members of the faculty who know the individual) that the student has demonstrated an inability to successfully complete the requirements of the School for the degree of Doctor of Medicine.

A decision by a CARP committee to drop a student from the School may be appealed. The appeal must be submitted, in writing, to the Dean of the School of Medicine within 72 hours of the student's receipt of notification of the committee's decision. Appeals will be considered within 30 days by a standing Appeals Committee appointed by the Dean. The Appeals Committee has limited authority either to uphold the earlier decision of the relevant CARP committee or to recommend to the Dean that the student be reinstated and allowed to continue his/her studies in the School. The reversal of a decision by a Committee on Academic Review and Promotions will be based only on a presentation of:

- (1) information which is new and/or different from that previously received by the CARP committee; or
- (2) evidence of extreme hardship of which the CARP committee was not fully apprised.

The Appeals Committee also serves for the Program in Occupational Therapy and the Program in Physical Therapy.

First Year Curriculum

The Committee on Academic Review and Promotions-I *may recommend* to any first semester student whose performance reflects difficulties with the required course work that he or she enter an individualized program. The Committee's recommendation will be based on a review of the student's performance in the first or second examinations in one or more of

the major* first semester courses. The intent of such an individualized program is to permit the student an optimum chance of successfully completing the requirements for the first year by permitting up to two years to complete the first-year's work. Students who accept the Committee's recommendation will be permitted to withdraw from one, or at the most two, of the major courses taught in the first semester, and will be eligible for individual tutorial help in the remaining courses. At the end of the first semester the Committee *may require* a student who has failed one or more of the major courses to enter an individualized program.

Students who experience academic difficulties after the first semester will be considered by CARP-I on an individual basis. A student who enters an individualized program is expected to pass all of his/her assigned courses in subsequent semesters in the School of Medicine.

Should a student in the first year of an individualized program fail any major course, one re-examination will be offered in each failed course at some time before the end of the summer preceding the next academic year. Should the student fail any re-examination, in the absence of such extenuating circumstances as personal ill health (physical or mental), he/she will be dropped from the School. Should a student in the second year of an individualized program fail more than two of the attempted courses, he/she will be dropped from the School. Should a student in the second year of an individualized program fail one or two of the attempted courses, a final re-examination in each failed course will be offered at some time before the end of the summer preceding the next academic year. If any such re-examination is failed, the student will be dropped from the School.

Second Year Curriculum

The Second Year curriculum of the Washington University School of Medicine is divided into three twelve-week trimesters. Prior to the end of each trimester there is a reading period followed by an examination period. As soon as possible following each examination period, coursemasters in Pathology, Pharmacology, Pathophysiology and Preparation for Clinical Medicine report student grades to the Registrar's Office. The Committee on Academic Review and Promotions-II then meets and reviews the academic performance of all students in the Second Year Class particularly those students who are reported as having academic problems. The following guidelines are suggested for the re-examination of students who have failed trimester examinations:

1. Since Pathology, Pharmacology, and Preparation for Clinical Medicine are year-long courses, and since each of the three trimester examinations is cumulative, re-examinations in these subjects are given only after the end-of-the-academic year meeting of CARP-II.

2. If a student fails one or more subjects in Pathophysiology, re-examination(s) will be offered according to the following schedule:

<i>Failure(s) in</i>	<i>Re-examination Schedule</i>
Trimester I	Re-examination(s) will be given during the first week after return from winter holiday break.
Trimester II	Re-examination(s) will be given during the first week after the spring break.
Trimester III	Re-examination(s) will be given during the last week of the interacademic year break.

Unless special permission is granted by CARP-II, a student in the Second Year Class may take re-examinations in no more than two subjects (e.g., Pathophysiology of the heart and kidney, or metabolism and pathophysiology of the lung) during each re-examination period. If a student fails initial trimester examinations in more than two subjects in Pathophysiology, re-examination(s) in these additional subject(s) must be deferred until after the end-of-the-academic year meeting of CARP-II.

3. At the end-of-the-academic year meeting of CARP-II, the academic records of all students in the Second Year Class will be reviewed. If a student has not taken an initial examination, or has not taken a re-examination in the subject(s) at the end of the appropriate trimester, the opportunity for examination or re-examination will be offered in each instance. CARP-II will determine for each student whether it is appropriate and practicable for the re-examination to be given during the last week of the three-week interacademic year period or whether the student should delay starting the clinical clerkship year for a variable time period for up to twelve weeks for the purpose of study and review. Students will be provided tutorial assistance as determined by CARP-II.

4. If a student has failed the initial examination and failed a re-examination in a section of Pathophysiology, at the discretion of CARP-II the student may either take a final re-examination at a prescribed time or repeat the course in the next academic year.

5. If a student, not on an individualized program, fails any final re-examination(s), CARP-II will determine whether the student should be dropped from the School of Medicine or permitted to repeat the specific course(s) during the next academic year.

6. The following rules pertain to students in the third year of an individualized program: At the end of Trimester-I, CARP-II may drop the student from the School if the student is failing two full-year courses

*The term "major courses" refers particularly to the first-year courses: Biochemistry, Gross Anatomy, Cell Biology, Physiology, Microscopic Anatomy, Neural Science, Immunology, Molecular Biology, and Microbiology and Infectious Diseases.

(i.e., pathology, pharmacology, preparation for clinical medicine) or one full-year course and two sections of pathophysiology after opportunity for a re-examination, or one full year course, one section of pathophysiology and one WUMS I course (If a student fails to take a scheduled re-examination, the result is recorded as a failure). At the end of Trimester-II, CARP-II may drop the student from the School if the student is failing two full-year courses or one full-year course and two sections of pathophysiology (after opportunity for re-examination following Trimester-I and/or Trimester-II).

At the end of Trimester-III and the opportunity for re-examination before completion of the last week of the interacademic year break, CARP-II shall drop the student from the School if the student has failed two full-year courses or one full-year course and two sections of pathophysiology. Students on individualized programs who have not completed successfully WUMS I and II coursework must remove all encumbrances by the start of the second six-week period of the clinical clerkship year, or be dropped from the School. Students in regular programs, who have not completed all course requirements by the end of Trimester-III but who are in the second year of residence as full-time medical students, shall have the option of not commencing clinical work until period three in order to complete re-examination procedure.

7. A student must take and pass or otherwise receive academic credit for all courses in the first two years of the curriculum before starting the clinical clerkships curriculum.
8. No student may take more than three years to complete the coursework required for the first two years of the curriculum. "Three years" is defined as completed when the class with which the student entered commences WUMS IV, period two (usually the third week of July).

Beyond the Second Year Curriculum

The Committee on Academic Review and Promotions-III meets several times each year to review the academic progress of all students enrolled in the clinical clerkship and elective years. This includes students in the regular four-year M.D. program, students taking a five-year M.A./M.D. degree program, students in the clinical portion of the Medical Scientist Training Program, those selected students with a prior Ph.D. degree who have been approved by the Medical Science Training Placement Curriculum Committee for individualized curricula and are now in the clinical training period of their program and all others who have successfully completed all aspects of the School's preclinical curriculum. Before the end of each academic year, the Committee meets and recommends to the Executive Faculty those students who, in the opinion of the Committee, are qualified to receive the degree of Doctor of Medicine. Specific rules are as follows:

1. All academic encumbrances must be removed in order for a student to be recommended for graduation.
2. If a student does not achieve or maintain a satisfactory level of scholarship as determined by one or more departments in the School of Medicine, CARP-III may require the student to repeat a clerkship or elective, take a re-examination or may drop the student from the School.
3. The granting of the Doctor of Medicine degree indicates that, in the opinion of CARP-III, the student has the intellectual, personal and moral qualities and the integrity, commitment and sense of responsibility appropriate for the practice of medicine.



ST. LOUIS

It comes as no surprise to residents—natives and newcomers alike—that St. Louis is considered to be among the 10 most livable areas in the United States. In health care, education, and transportation, St. Louis ranks among the top 20. For recreation, the lively arts, and great everyday living, St. Louis is a city of opportunity and variety.

The Gateway Arch—St. Louis' preeminent symbol—represents the joining of old and new on the historic Mississippi riverfront. Rising in front of a dramatic skyline, the Arch symbolizes St. Louis' role as the gateway to the West. Today, as in the past, St. Louis is a prominent cultural and commercial city, linking the north and south, east and west, through its traditions and its view of the future. The Arch itself, designed by Eero Saarinen, is a remarkable sculptural achievement and an incredible engineering feat, worthy of its dramatic setting. It frames the commercial center of downtown, and the Old Courthouse where in 1847 Dred Scott argued his right to be a free man.

Ambitious renovation and architectural experimentation characterize busy downtown St. Louis. The Old Post Office and the massive Romanesque Union Station have recently been revitalized. Union Station now houses a hotel and expansive shopping mall, inviting convention visitors and tourists to explore commerce St. Louis-style. New corporate headquarters buildings downtown display the variety of modern architecture evident in major metropolitan centers around the nation. Members of the Washington University School of Architecture consult with local firms in the creation of new structures and the refurbishing of the old. A new housing area in the fashionable Central West End, home to the Washington University Medical Center, is the design of a School of Architecture professor.

Though the St. Louis area has nearly 2.5 million residents, living here is simple and affordable. You are never farther than a 20-minute drive from any place you want to go in the metropolitan area, especially from Washington University's central location in suburban St. Louis. A convenient, modern highway system and a simple city plan allow easy access to all parts of the city and its many activities.

A keynote to St. Louis is variety. Any taste in housing, cuisine, lifestyle, and leisure activities can be found in the greater St. Louis area, but St. Louis is less expensive than comparable cities. Attractive, affordable residential communities abound here, many of them within a two-mile radius of Washington University. The University is bordered by delightful neighborhoods. The Central West End, University City, and Clayton—all of which border Washington University—provide attractive housing and recreational opportunities. To the north, small shops, galleries, and ethnic restaurants dot the main street of University City. Adjacent to the Washington University Medical Center and the Hilltop campus is the Central West End, fashionable, trendy, and restored to its late-19th century grandeur. To the south are the elegant homes and multi-family dwellings of Clayton. For those who desire a more suburban lifestyle, west St. Louis county is a growing and beautiful area.

Cultural Opportunities

Once settled, new St. Louisans discover the rich recreational and cultural life here. You see the effects of the St. Louis renaissance in its theatre, galleries, and festivals. The St. Louis Symphony, second oldest and among the finest in the nation, performs at historic Powell Hall. Symphony members bring their skills to the community through teaching and chamber concerts as well. Several hold appointments in



the Washington University music department. The music department also has close ties with the St. Louis Conservatory and Schools for the Arts (CASA), an institution offering high-level intense training in music and the arts. In the downtown area, the rich St. Louis traditions in jazz, blues, and ragtime music are continued in a number of lounges and clubs.

Broadway comes to St. Louis at the Fox Theatre, a \$2 million renovation of a 1929 example of exotic cinema temple art. Galleries sprinkled throughout the area bring the most current in visual arts to St. Louis and antique shops remind us of the past. St. Louisans tend to be avid movie goers. Supplementing the standard movie fare available throughout the metropolitan area are two theatres close to campus, the Tivoli and the Hi-Pointe, offering excellent foreign films.

Fourteen years old in 1989, the Opera Theatre of St. Louis has been enormously successful, nationally and internationally, bringing English-language versions of the classics and presentation of contemporary operas to the stage. The Repertory Theatre of St. Louis has an extensive annual season which includes experimental works and traditional dramas. The Theatre Project Company, City Players of St. Louis, and the Black Repertory Theatre enrich the dramatic offerings available in the immediate area, and right on campus the Edison Theatre offers a varied program each season.

When the St. Louis city art museum was built for the 1904 World's Fair, much of the Washington University collection was housed in it. Standing on a hill in Forest Park, the museum was called the jewel of the Fair. By 1929, it exhibited the entire University art collection and provided space for fine arts students and faculty shows.

Though in 1960 Washington University built its own museum—the Gallery of Art housed in Steinberg Hall—and moved its collection there, ties with the St. Louis Art Museum remain very close. Students in art and in business intern at the Art Museum working in arts management and gallery organization. St. Louis also features one of the world's few sculpture gardens, Laumeier International Sculpture Park. The park has 60 large-scale sculptures representing artists of international renown. St. Louis has two major historical museums as well: the Missouri Historical Society in Forest Park and the Museum of Westward Expansion under the Gateway Arch.

Recreation

For recreation, St. Louisans may use any of 93 parks which dot the metropolitan area. In Forest Park, which lies between the Washington University Medical Center and Hilltop campuses, are the Art Museum, MUNY Opera, the famed St. Louis Zoo, St. Louis Science Center's McDonnell Planetarium, the Jewel Box Floral Conservatory, three municipal golf courses, tennis and handball courts, a skating rink, and acres of paths, picnic areas, gardens, and



wooded groves. Tower Grove Park is in south St. Louis, and adjoining it is the Missouri Botanical Garden, world famous for its research, collections, and facilities. The Garden's professional staff holds positions on the Washington University faculty and makes the extensive research facilities available to students.

Farther afield, St. Louis residents find outdoor adventure in the countryside beyond the city. In the Ozark Mountains, on the rivers of Missouri, on the lakes of neighboring Illinois, variety abounds. Camping, hiking, floating, rock climbing, and caving are among the many possibilities within a few hours' drive of St. Louis. For sailors, there is Lake Carlyle in Illinois. And for those with rod and reel, the Missouri streams are made-to-order.

The Washington University Athletic Complex, completed in 1985, is a full-service facility open to all members of the University community. It includes an 8-lane, 25-meter stretch pool, two complete gymnasiums, weight rooms, racquetball courts, a complete outdoor tennis complex, and a new track complex. Built on the site of the 1904 Olympic games, this state-of-the-art facility provides year-round recreational opportunities for students, faculty, and staff.

For the spectator, St. Louis is a splendid sports town. For over a century, it has hosted one of the oldest traditions in baseball—the St. Louis Cardinals. Dizzy Dean and the Gas House Gang, Lou Brock, Ozzie Smith, and Stan Musial are all part of Cardinal history. Busch Stadium is the home of the Cardinals.

Traditionally, St. Louis is one of the great soccer cities in the country. It is the nation's high school and

college soccer capital and recently hosted a qualifying round for the World Cup.

The ice hockey book in St. Louis began when the Blues moved here in 1967. They have a winning history and play 40 games per year in the Arena.

Employment

St. Louis is a great place to work: job opportunities are varied and abundant; many companies are distinguished for their excellent working conditions, and commuting is easier than in many large cities.

Since the 1960s, the St. Louis area has enjoyed an influx of corporate headquarters and offices. Fifty-nine Forbes 500 companies have offices in Clayton alone. And in the nine-county region of St. Louis, more than 500 Fortune 1000 Companies have a branch, and 10 of the Fortune 500 are headquartered here. In addition, major insurance, retail, transportation, and banking organizations are in St. Louis. Among the top firms in town are Anheuser-Busch, The Brown Group, McDonnell Douglas, Monsanto, Pet and Ralston Purina—all founded in St. Louis. St. Louis is a major hub for Trans World Airlines. Since St. Louis is chosen so frequently as a headquarters location, many support services have grown around them—law, accounting, data processing, advertising, public relations, and design firms, as well as photographic and audio visual studios.

One of the largest employers is the Washington University Medical Center—composed of the School of Medicine and several teaching hospitals. Illustrative of the productive ties between university and community, the Monsanto Company supports molecular biology research at the School of Medicine and has contracted with Washington University for biomedical research.

The School of Business at Washington University enjoys a special relationship with the business community. As a laboratory for student study, for internship opportunities, and for permanent employment of business graduates, the St. Louis business community plays an integral role in the education of undergraduate and graduate business students. Faculty consultants work with corporations to explore new opportunities for growth and development of their firms. The local business and professional communities have also been very supportive of a new graduate internship program making part-time jobs available to advanced graduate students in the humanities and social sciences divisions of the Graduate School of Arts and Sciences.

Similarly, the School of Law has close ties with the St. Louis legal community and, through its clinical program, offers internships in private and local government offices and in state and federal courts. In addition, the law school is fortunate in the active and interested role of the local bar associations in the development of the school's special programs.

The George Warren Brown School of Social Work is also linked in many ways to the St. Louis social work community. Students find practicum assignments throughout the area and faculty both do research and consult with local agencies.

In short, Washington University, though a national research university, enjoys a close, even special relationship with the St. Louis area.

STUDENT LIFE

Housing

Those who come to St. Louis to be associated with Washington University School of Medicine find apartments which range in price from \$250-\$600 per month, all in the immediate area. The Apartment and Housing Referral Services, located in Millbrook Square on the Hilltop Campus, maintains listing of housing appropriate for married and single students. For information, contact Apartment and Referral Services, 6926 Millbrook Blvd., Box 1059, St. Louis, Missouri 63130 (Telephone: (314) 889-5092).

The Spencer T. Olin Residence Hall, located at 4550 Scott Avenue in the Medical Center, has accommodations for approximately 200 single men and women. The building was made possible by generous gifts from Spencer T. Olin, alumni and friends of the School of Medicine. Olin Hall is planned for the convenience of students in the medical or paramedical sciences. Every effort is made to provide an atmosphere that not only aids them in meeting their study obligations, but also recognizes their privileges as graduate students.



The rates for rooms during 1989-90 are:

School Year: September-June (Nine Months)

Two-room suite	\$2,805
Single room	\$2,050
Double room	\$1,390
Large single	\$2,530

Summer 1989: for Three Months

Two-room suite	\$890
Single room	\$650
Double room	\$440
Large single	\$800

Summer 1989: Weekly Rates for Student Visitor

Two-room suite	\$87
Single room	\$78
Double room	\$69

Daily Rates for Visitors

Two-room suite (furnished)	\$37
Single room	\$29
Single room (prospective student)	\$26

Parking

Parking is available on lots owned and operated by the School of Medicine. These lots are located near Olin Hall and various other sites within the Medical Center. This includes the Busch lot which is fenced and shared equally by the School of Medicine and Barnes Hospital. An annual permit must be purchased for the use of any of the surface parking lots. These permits are available to students on a limited basis. If space is available, students also qualify to purchase monthly parking cards in the Washington University Garage at the corner of Audubon and Euclid Avenues.

Student Health Service

Entering students are required to have a medical examination prior to matriculation, and to show proof of immunity to measles (rubeola), rubella and mumps. Subsequent medical care is provided as long as they are enrolled in the School of Medicine. Physicians are available at the Student Health Service, and a physician is on call for emergency care at Barnes Hospital. Essential costs of hospitalization are covered. The student or his family is responsible for meeting the costs of hospital care in excess of those paid by the Health Service. The responsibility of the Student Health Service for hospitalization will end 30 days after an individual ceases to be an officially enrolled student.



Student Activities

Medical School Jazz Ensemble

The "Hot Docs," now in its eleventh year of existence, is a fully instrumented big band jazz ensemble. The 20-member group, composed of predominantly Washington University medical students, rehearses weekly and performs at concerts and dances throughout the year. The band's large repertoire spans several musical generations, with the music of Miller, Dorsey, Basie, and Gillespie as well as present day jazz and pop composers represented.

The "Hot Docs" provide one of several ways students can continue to pursue long-time special interests in addition to their medical education.

Student Organizations

Students at Washington University School of Medicine are active participants in medical student organizations on the local, state and national levels. The American Medical Student Association (AMSA), the American Medical Women's Association (AMWA), the Medical Student Section of the American Medical Association (AMA), the Missouri State Medical Association (MSMA), and the Organization of Student Representatives (OSR) in the Association of American Medical Colleges (AAMC), provide forums for addressing the educational, social and political concerns of medical students. The School of Medicine supports student participation in these national organizations and provides on an annual basis funds for travel and other expenses.

On the local level, AMSA is the major student organization at the School of Medicine. The chapter's annual activities include a bi-weekly speaker series,

a book sale for entering students, and several community service projects. In recent years, the service projects have included an ongoing blood pressure screening program done in conjunction with the American Heart Association, the Perinatal Project, presentations to St. Louis area high school students on the effects of alcohol and drug abuse, and participation in health fairs sponsored by a variety of organizations in the city.

Intramural Program

Students enrolled in the Washington University School of Medicine enjoy an active and diverse Intramural (IM) Program. The IM Program offers students the opportunity to participate in a wide range of sports. Utilizing the state-of-the-art facilities in the University's newly-constructed Athletic Complex, medical students pursue personal athletic interests and enjoy interaction with students enrolled in both undergraduate and graduate degree programs. The IM Program provides an excellent opportunity to socialize with colleagues as well as other graduate students. Differences in curricular demands among participants are considered in scheduling games so that neither academic nor athletic goals are compromised.

Traditionally, the School of Medicine is represented each year by teams or individuals in over ten intramural sports. During the 1988-89 season, medical student teams competed in men's and women's flag football, soccer, volleyball, cross country, basketball, swimming, softball and track and field as well as coed ultimate frisbee, volleyball, inner-tube water polo and softball. In addition, there are different levels of competition so that the needs of both the competitive and recreational athlete can be met. The School has always made a strong showing in both the mixed and graduate school division, as evidenced by the many championship T-shirts team members sport.

Academic Societies

To foster communication between students and faculty, three academic societies—The Joseph Erlanger Society, The Carl and Gerty Cori Society, and the Oliver Lowry and Carl Moore Society—meet independently throughout the academic year to enjoy a social hour, dinner, and conversation stimulated by an after-dinner speaker. The Societies promote a collegial environment for the medical school's diverse faculty and student body.

Student Research Fellowships

No matter what medical career is chosen, it will be essential for the student to evaluate and use fresh knowledge throughout his or her professional life. Student Research Fellowships in basic science or clinical areas, awarded each year to selected students who undertake research projects under the direction of faculty members, are an important part of the



educational program. Research allows students to discover firsthand the problems and rewards of obtaining and assessing new information, thus adding another dimension to their experience as investigators. Selected faculty members serve as advisors to students interested in special research opportunities.

Fellowships are available to students after acceptance into the School. They carry a stipend. The research must be undertaken for a minimum of two months during the student's free time or a vacation period. Application should be made to the Committee on Fellowships and Awards, Campus Box 8093.

Awards and Prizes

Washington University School of Medicine publicly recognizes and rewards at two annual events outstanding scholarship, research accomplishments and community service of individual students. In December, the Student Awards Luncheon acknowledges academic excellence earned during the first three years of study. As part of the festive commencement activities in May, graduates are recognized for meritorious research and clinical achievements accomplished during their medical school careers.

Alpha Omega Alpha Book Prize. Awarded at the end of the fourth year to a member of the graduating class who has performed outstandingly for the entire medical course.

American Heart Association Research Fellowship Award. Given for outstanding performance in the American Heart Association Medical Student Research Fellowship Program.

Alexander Berg Prize. Awarded to the student presenting the best results in research in bacteriology.

Jacques J. Bronfenbrenner Prize. Provided by Dr. Bronfenbrenner's students in memory of his inspiration as a teacher and scientist, and awarded to the member of the graduating class who, in the judgment of the Chairman of the Department of Medicine, has done the most outstanding work in infectious diseases or related fields.

Dr. Richard Brookings and Dr. Robert Carter Medical School Prizes. Provided for medical students through a bequest of Robert S. Brookings.

Dr. Harvey Butcher Prize in General Surgery. Awarded annually, in memory of Dr. Harvey Butcher, to the member of the graduating class who, in the opinion of the Department of Surgery, shows the greatest promise for general surgery.

Kebar S. Chouke Prize. Awarded at the end of the first year to a medical student who has demonstrated superior scholarship in anatomy.

CIBA Award for Outstanding Community Service. Recognizes a second-year student who has performed laudable extracurricular activity within the community.

Carl F. and Gerty T. Cori Prize in Biochemistry. Awarded at the end of the first year to the member of the class who has demonstrated superior scholarship in biochemistry.

Edmund V. Cowdry Prize in Histology. Established in 1969 to honor Dr. Cowdry; awarded to a medical student in the First Year Class who has performed meritoriously in microscopic anatomy.

Antoinette Frances Dames Prize in Physiology and Biophysics. Awarded annually to a member of the First Year Class who has demonstrated superior scholarship in these fields.

Elisabeth L. Demonchaux Prize in Pediatrics. Established in 1985, the prize is awarded annually to a graduating student who has done outstanding work in pediatrics.

George F. Gill Prizes. One prize awarded at the end of the first year to a member of the class who has demonstrated superior scholarship in anatomy; one prize awarded to a member of the graduating class who has demonstrated superior scholarship in pediatrics.

Alfred Goldman Book Prize. Created in 1972 as an annual award to be given to a student in the School of Medicine who, in the opinion of the faculty, has done outstanding clinical work or research in diseases of the chest or pulmonary physiology.

Max and Evelyn Grand Prize. Established in 1985 by Dr. M. Gilbert Grand, the prize is awarded annually to a medical student in the Fourth Year Class for excellence in ophthalmic research or clinical ophthalmology.

Isbiyaku EuroAmerica-Piccin Nuova Libreria Book Prize. Awarded for the first time at graduation in 1985, selection is based on general academic excellence throughout the recipient's medical education.

Dr. J. E. Kirk Scholastic Award. Established in 1975 and awarded to a graduating student of high scholastic standing.

Louis and Dorothy Kovitz Senior Prize in Surgery. Senior award prize in surgery recognizing a member of the Fourth Year Class who has shown the most outstanding ability, zeal, and interest in surgical problems.

Lange Medical Publications Student Awards. Given to members of all four classes for high scholastic standing.

I. Wallace Leibner, M.D. Award. Established in 1988 in memory of Dr. Leibner, the award is given to the member of the graduating class who has demonstrated outstanding ability in the clinical practice of medicine.

Irwin Levy Memorial Fund. Established in 1980 by friends of Dr. Levy as a tribute to his commitment to clinical teaching. Provides a prize for the student who presents the best performance in the neurology and neurological surgery clerkship.

Oliver H. Lowry Prize. Awarded to a second-year medical student for academic excellence in pharmacology.

Howard A. McCordock Book Prize. Awarded at the end of the second year to a member of that class for general excellence in pathology.

McGraw-Hill Book Prize. Awarded annually to a medical student for outstanding achievement in the first-year curriculum.

Edward Massie Prize for Excellence in Cardiology. Awarded to the member of the graduating class who, in the judgment of the Director of the Division of Cardiovascular Disease of the Department of Medicine, has done the most outstanding clinical or basic research work in the field of cardiovascular disease.

Medical Center Alumni Scholarship Prize. Given annually to a student who has shown excellence in his or her work during the preceding year.

Medical Fund Society Prizes. One prize awarded annually to a student of the Fourth Year Class who has excelled in the study of internal medicine; one prize awarded annually to a student of the senior class who has excelled in the study of surgery. No individual is eligible for both prizes.

Minority Medical Students Scholarship Prize. Provided by Black alumni and friends of Washington University School of Medicine, the prizes are awarded to Minority Scholarship recipients in recognition of their achievements in the first-year curriculum.

Missouri State Medical Association Award. A scroll and a U.S. Savings Bond presented annually to an honor graduate of the senior class.

C. V. Mosby Company Book Awards. Made to five members of the graduating class for high general scholastic standing and research achievement.



Dr. Philip Needleman Pharmacology Prize. Established by his family in 1989, in honor of Dr. Needleman, Chairman of the Department of Pharmacology, 1976-1989. This annual award is given to a member of the graduating class for outstanding research in pharmacology.

James L. O'Leary Neuroscience Prize. Awarded annually to students who demonstrate the best accomplishments in the neuroscience course.

James L. O'Leary Prize for Research in Neuroscience. Given annually to a predoctoral or postdoctoral student for the most original and important accomplishment in neuroscience research.

St. Louis Internists Club Book Prize. Awarded to the member of the graduating class who has done the most significant research in any area of internal medicine.

St. Louis Pediatric Society Senior Prize. Presented to the senior student showing the greatest promise in clinical pediatrics.

Sandoz Award. Given annually to a graduating student who has made a meritorious contribution to psychiatric research.

Sidney I. Schwab Prize in Psychiatry. Awarded at the end of the fourth year for general excellence in psychiatry.

John R. Smith Memorial Fund Prize. Created in 1982 to be awarded annually to a medical student who has done meritorious clinical and/or research work in the Division of Cardiovascular Disease of the Department of Medicine.

Margaret G. Smith Award. Given to a woman medical student for outstanding achievement in the first two years of medical school.

Samuel D. Soule Award in Obstetrics and Gynecology. Presented to a member of the Third or Fourth Year Class for meritorious achievement in either basic or clinical investigation in obstetrics and gynecology.

Upjohn Achievement Award. Given to the fourth-year student who has done the most meritorious work during his or her medical school career in the field of metabolism.

Washington University School of Medicine Academic Achievement Award. Given annually to a student who has exhibited to an unusual degree the qualities of industry, perseverance, determination, and enthusiasm in the first-year academic program.

Samson F. Wennerman Prize. Donated by his wife, Zelda E. Wennerman, and awarded annually to that fourth-year student who has demonstrated promise in surgery.

Hugh M. Wilson Award for Meritorious Work in Radiology. Given annually to a graduating medical student in recognition of outstanding work in radiology-related subjects, either clinical or basic science.

James Henry Yalem Prize in Dermatology. Established by Charles Yalem in memory of his son and awarded annually to a member of the Fourth Year Class for outstanding work in dermatology.

Lectureships and Visiting Professorships

Several established lectureships enable the School to bring to the Medical Center each year distinguished guests who contribute significantly to the richness of student life.

Ben T. Abelson Memorial Lectureship in Pediatric Hematology-Oncology. Established by Mrs. Ben T. (Ann) Abelson, the first lecture was held on January 8, 1988.

Harry Alexander Visiting Professorship. Established in 1964 by former house officers and friends of Dr. Harry Alexander to provide an annual visiting professor in the Department of Medicine.

Alpha Omega Alpha Lectureship. Given each year by a faculty member of the students' selection.

Daniel R. Biello Memorial Lectureship. Established in 1986 by friends, students and colleagues of Dr. Daniel R. Biello to provide an annual lectureship devoted to advances in radiology and nuclear medicine.

George H. Bishop Lectureship. Supported by funds made available by friends interested in the advancement of neurology.

Estelle Brodman Lectureship Fund. Established in 1981 by friends and colleagues of Dr. Brodman in honor of her distinguished contributions to the School of Medicine.

The James Barrett Brown Visiting Professorship in Plastic and Reconstructive Surgery. Created in 1969 by patients, friends, colleagues, and former students to honor Dr. Brown.

Thomas H. Burford Lectureship in Thoracic Surgery. Founded in 1971 by friends of Dr. Burford.

Glover H. Copher Lectureship in Cancer. Founded in 1971 with endowment provided by Dr. Copher and friends.

The Carl F. and Gerty T. Cori Visiting Professorship. Established in 1985 in honor of Nobel Laureates Carl and Gerty Cori by the Edward Malinckrodt, Jr. Foundation, colleagues, faculty and former students.

I. Jerome Flance Visiting Professorship. Established in 1977 by former students and friends of Dr. Flance to provide annually a visiting professor in the Division of Pulmonary Diseases.

Julia Hudson Freund Lectureship. Established in 1982 by S. E. Freund in memory of his wife to provide a visiting lectureship in clinical oncology.

Edwin F. Gildea, Jr., Lectureship in Psychiatry. Established in 1978 by friends, colleagues, and former students of Dr. Gildea.

Joseph J. Gitt Visiting Professorship in Clinical Neurology. Established in 1971 by his family and friends to honor Dr. Gitt.

Graham Colloquium. A gift from Mr. and Mrs. Evarts Graham, Jr., in 1963 to encourage opportunities for students to expand their views on social, philosophical, artistic, and political topics.

The Evarts A. Graham Lecture. Established in 1985 by the Washington University Alumni of the Phi Beta Pi medical fraternity to honor the memory of Dr. Evarts A. Graham.

Evarts A. Graham Memorial Lectureship. Established in 1959 with a reserve fund left by Dr. Graham for his successors.

Evarts A. Graham Visiting Professorship of Surgery. Established in 1968 by The Harry Freund Memorial Foundation to support an annual lecture in honor of Dr. Graham's contribution to surgery.

Samuel B. Grant Visiting Professorship. Created in 1963 to provide annually a visiting professor in the Department of Medicine.

Carl Gayler Harford Lectureship. Established in 1977 by the family of one of Dr. Harford's patients in gratitude for his contributions to teaching clinical medicine and virology.

Alexis F. Hartmann, Sr., Lectureship. Established in 1960 by friends interested in pediatrics to provide an annual lecture in Dr. Hartmann's honor.

Michael and Irene Karl Lectureship in General Internal Medicine. Created in 1983 by Mr. and Mrs. Meyer Kopolow to provide an annual lectureship in honor of Drs. Michael and Irene Karl.

Paul E. Lacy Lectureship in Pathology. Established in 1987 by The Kilo Diabetes and Vascular Research Foundation in honor of Dr. Lacy's many contributions to pathology and diabetes research, and to recognize his collaboration over the years with the co-founders of The Kilo Foundation.

Irwin Levy Memorial Fund. Supports the Dr. Irwin Levy Visiting Lectureship in Neurology, which was established in 1978 by Mr. and Mrs. Meyer Kopolow.

Oliver H. Lowry Lectureship. Established in 1978 by friends, colleagues, and former students of Dr. Lowry.

H. Relton McCarroll, Sr., Visiting Professorship in Orthopedic Surgery. Created in 1972 by patients, friends, colleagues, and former students in honor of Dr. McCarroll.

Edward Massie Lectureship in Cardiovascular Disease. Established in 1981 by Edward J. Simon, M.D., Bernard Shanker, and other grateful colleagues and patients.

Carl V. Moore Lectureship. Established in 1973 by friends and patients of Dr. Carl V. Moore.

Carl A. Moyer Visiting Professorship of Surgery. Established in 1978 by The Harry Freund Memorial Foundation to support an annual lecture in honor of Dr. Moyer's contribution to surgery.

Joseph H. Ogura Lectureship. Established in 1977 by friends and colleagues of Dr. Ogura as a tribute to his numerous scientific accomplishments and contributions to the School of Medicine, graduate medical education, and commitment to patient care.

Rose and Samuel Pollock Surgical Lectureship. Established in 1976 by Dr. Joseph H. Pollock in memory of his parents.

The Probststein Oncology Lectureship. Established in 1985 by Mr. and Mrs. Norman K. Probststein in appreciation of professional services provided by William Fair, M.D., former head of the urology division of the Department of Surgery, and Carlos Perez, M.D., professor of radiology and head of radiation oncology at the Medical Center's Mallinckrodt Institute of Radiology.

Eli Robins Lectureship in Psychiatry. Established in 1977 by friends, colleagues, and former students of Dr. Robins.

St. Louis Football Cardinals Visiting Professorship in Orthopedic Surgery. Made possible since 1971 by donations from the St. Louis Football Cardinals.

Henry G. Schwartz Lectureship. Created in 1983 by former residents and colleagues from the neurosurgery department to honor Dr. Schwartz.

Wendell G. Scott Memorial Lectureship. Established in 1972 by friends and colleagues of Dr. Wendell G. Scott.

Major G. Seelig Lectureship. Established in 1948 in the field of surgery by friends of Dr. and Mrs. Seelig.

Philip A. Shaffer Lectureship. Founded in 1957 by friends of Dr. Shaffer in recognition of his accomplishments in biochemistry.

Eduardo Slatopolsky Lectureship. Established in 1988 by Mr. and Mrs. William Wolff in honor of Dr. Slatopolsky's 25-year association with the School.

C. R. Stephen, M.D., F.F.A.R.C.S. Fund for Lecture and Clinical Research in Anesthesiology. Established in 1986 by former students, residents, faculty and friends in honor of Dr. Stephen, first Head of the Department of Anesthesiology.

Sterling Drug Visiting Professorship in Pharmacology. Established in 1986 to honor Ernst Zander, M.D., former medical director of Sterling Drug, Inc.

The Donald B. Strominger Visiting Professorship. Established in 1984 by family, friends, and colleagues, fellows, and patients of Dr. Strominger in honor and in memory of his dedication and contributions to their lives, their careers, and to the field of medicine in pediatrics.

The Richard A. and Betty H. Sutter Visiting Professorship in Occupational and Industrial Medicine. Established in 1985 by Dr. and Mrs. Sutter to encourage opportunities for students, faculty, other physicians, and the St. Louis community to expand the understanding and practice of Occupational Medicine.

Jessie L. Ternberg Pediatric Surgery Visiting Lectureship. Made possible from a fund established in 1977 by Mr. Meyer Kopolow to honor Dr. Ternberg.

Robert J. Terry Lectureship (1939) and Visiting Professorship (1982). Established by alumni and Charles S. Terry, his son, respectively, "for the purpose of fostering greater appreciation of the study of anatomy."

Mildred Trotter Lectureship. Established in 1975 by friends and former students of Mildred Trotter to bring a distinguished woman scientist to the School of Medicine each year.

Rudolph A. Tuteur Pulmonary Lectureship. This lectureship is endowed by family, friends, patients, and colleagues of the Tuteur family to memorialize Rudolph A. Tuteur. The goal of this annual fall event is to promote further understanding of problems associated with chronic pulmonary disease from which he suffered.

THE WASHINGTON UNIVERSITY GRADUATE

Residency Training

Although not required by all states for licensure, postgraduate residency training in an approved hospital is considered essential preparation for the practice of medicine. Most Washington University graduates serve three or more years of residency training, and some will gain additional experience as postdoctoral fellows.

In order to aid students in obtaining desirable residency appointments, an active counseling program is maintained by the Associate Dean for Postgraduate Training. Thus, students in the Third Year Class are provided with general background information about the kinds of residencies available, special problems concerning certain extremely competitive residencies, and help in identifying faculty members for further assistance. Since the number of available residencies has recently decreased to approximately the same as that of graduates applying, students must make their choices with considerable care.



The Associate Dean for Postgraduate Training maintains an open file of brochures and other descriptive data regarding residencies throughout the country. Included are evaluations of the residency experience of our recent graduates. The School participates in the National Resident Matching Program, which offers distinct advantages to applicants.

Results of these efforts have been gratifying. In 1989, graduating students who participated in the National Residency Matching Program matched one of their top three choices in 87 percent of cases, with 60 percent obtaining their first choice of residency. The PGY-1 residencies selected in the most recent residency matching (1989) are identified in the Register of Students beginning on page 186.

The School maintains an active interest in its graduates and is pleased to assist them in subsequent years as they seek more advanced training or staff appointments in the communities in which they settle.

Postdoctoral Training

Those departments which offer Postdoctoral Fellowships individualize such educational activity up to a maximum of 36 months of academic time. Such fellowships lead integrally to certification by the appropriate specialty and/or subspecialty boards of the American Medical Association.

Fellowship And Other Funds

Alexander and Gertrude Berg Fellowship Fund. Created in 1952 through the bequest of Gertrude Berg to provide a fellowship in the Department of Microbiology.

Glover H. Copher Fellow in Surgical Research. Established in 1971 to support a postdoctoral fellow in surgery.

William H. Danforth Loan Fund for Interns and Residents in Surgery. Provides financial assistance in the form of loans for postdoctoral students in surgery.

J. Albert Key Fellowship Fund. Provides a stipend for a fellow in orthopedic surgery.

Louis and Dorothy Kovitz Fellowship Fund. Established in 1970 by an alumnus and his wife to provide support for research by qualified residents or students interested in surgery, at the discretion of the Head of the Department of Surgery.

Stephen I. Morse Fellowship. Established in 1980 by Carl and Belle Morse in memory of their son; awarded to predoctoral or postdoctoral students pursuing research careers in microbiology, immunology, and infectious diseases.

The Esther and Morton Wohlgenuth Foundation Fellowship. Established to support a fellow in the Division of Cardiovascular Diseases.

Continuing Medical Education

The study of medicine is a lifelong process with continuing medical education being an integral part of the continuum. Since 1973 the School of Medicine has formally met its obligations to this learning endeavor through the operation of the Office of Continuing Medical Education. The objectives of this program are:

- 1) To provide high quality educational activities for alumni of Washington University School of Medicine and other physicians regionally and, on occasion, nationally.
- 2) To encourage lifelong learning by a variety of educational methods appropriate to the learners' needs.
- 3) To provide for the acquisition of new knowledge and skills and to aid in acquiring efficient problem-solving techniques for ultimate improvement in patient care.
- 4) To provide a forum where academic and practicing physicians can jointly explore solutions to health problems.
- 5) To translate the results of research and the habits of critical assessment of new data to the needs of practicing physicians.

Each year 40 to 50 symposia and approximately 70 academic rounds and conferences on a wide variety of topics are accredited by this office. About 4,000 registrants attend these courses annually and receive more than 500 hours of instruction. In addition to formal courses, the CME office sponsors computer-assisted instruction, a pediatric newsletter, audiotapes, mini-residencies, and a speaker's bureau. It supports continuing medical education in selected community hospitals. The educational program is fully accredited by the Accreditation Council for Continuing Medical Education and provides credits to physicians seeking them for the Physician's Recognition Award of the American Medical Association, as well as various other types of state and specialty recertification and relicensure activities.

Washington University Medical Center Alumni Association

The Washington University Medical Center Alumni Association was organized more than 55 years ago to foster a spirit of class fellowship among its members, and to further the interests and standing of the School of Medicine. Membership is available to graduates and former house officers of the Medical Center.

In order to complement the aims and purposes of the School of Medicine, the Association sponsors a variety of programs including: student-alumni activities, recognition programs, alumni service programs, and other special events.

Student-Alumni Programs: The Washington University Medical Center Alumni Association Student Loan Fund underscores the commitment to assist deserving young men and women. Generous contributions made by members of the Association provide a special fund which offers short-term, no interest loans to medical students upon recommendation of the Office of Student Affairs.

To further alumni-student relationships, the Association coordinates the Alumni-Freshman Visitation Program, designed to give first-year medical students the opportunity to spend a day on the job with a practicing physician.

A tradition at the School of Medicine, the Association brings together alumni, faculty, and first-year students for a welcoming party during orientation week.

Recognition Programs: Alumni and friends of the School of Medicine who make unrestricted contributions of \$100 to \$249 to the School or any of its departments are recognized by membership in the Medical Century Club. The second level of club membership, the Century Club Fellows, recognizes those who contribute \$250 to \$499 annually in unrestricted support. Alumni and friends contributing \$500 to \$999 each year to ongoing programs at the School of Medicine are honored by Dean's Committee membership.

In 1977 members of the Medical Eliot Society, through the William Greenleaf Eliot Society of the University, initiated the Alumni Endowed Professorship Program, designed to establish Alumni Professorships through collective \$1,000 annual contributions from alumni. The first Alumni Professorship was completed for Pharmacology in 1982. The second chair was endowed in Pediatrics in 1985, and the third designated for Molecular Microbiology in 1989. The goal is to have an Alumni Endowed Chair in each department at the School of Medicine. The Medical Scholars Loan Program was established by members of the William Greenleaf Eliot Society in 1985. This fund provides an interest-free source of long-term student loans. Annual contributions from alumni and friends support this perpetual and growing resource upon which current and future medical students will draw. Recognizing the critical part which gifts play in the continued progress of Washington University, the William Greenleaf Eliot Society has established the following guidelines for donor recognition: Eliot Society Member, \$1,000--\$2,499; Eliot Society Fellow, \$2,500--\$4,999; Eliot Society Benefactor, \$5,000--\$9,999; Eliot Society Patron, \$10,000 or more.

Annually, Alumni-Achievement and Alumni-Faculty awards are presented at Reunion. Nominations for the awards, based on professional achievement and service to the School of Medicine, are solicited from all Reunion alumni. Reunion Chairmen, past award recipients and past presidents of the Alumni Association serve on the selection committee for the award recipients.

Alumni-Service Programs: The interest in postgraduate education expressed by leaders of the Alumni Association provided a major impetus to the initial development of the Office of Continuing Medical Education. Alumni in practice felt the need for a formal means to renew their educational experience under the auspices of their alma mater. Since establishment of the Office of Continuing Medical Education in 1973, alumni have supported its programs.

The Alumni Association prepares and distributes the Washington University School of Medicine Alumni Directory. Members' names, specialties, and current addresses are contained in this publication.

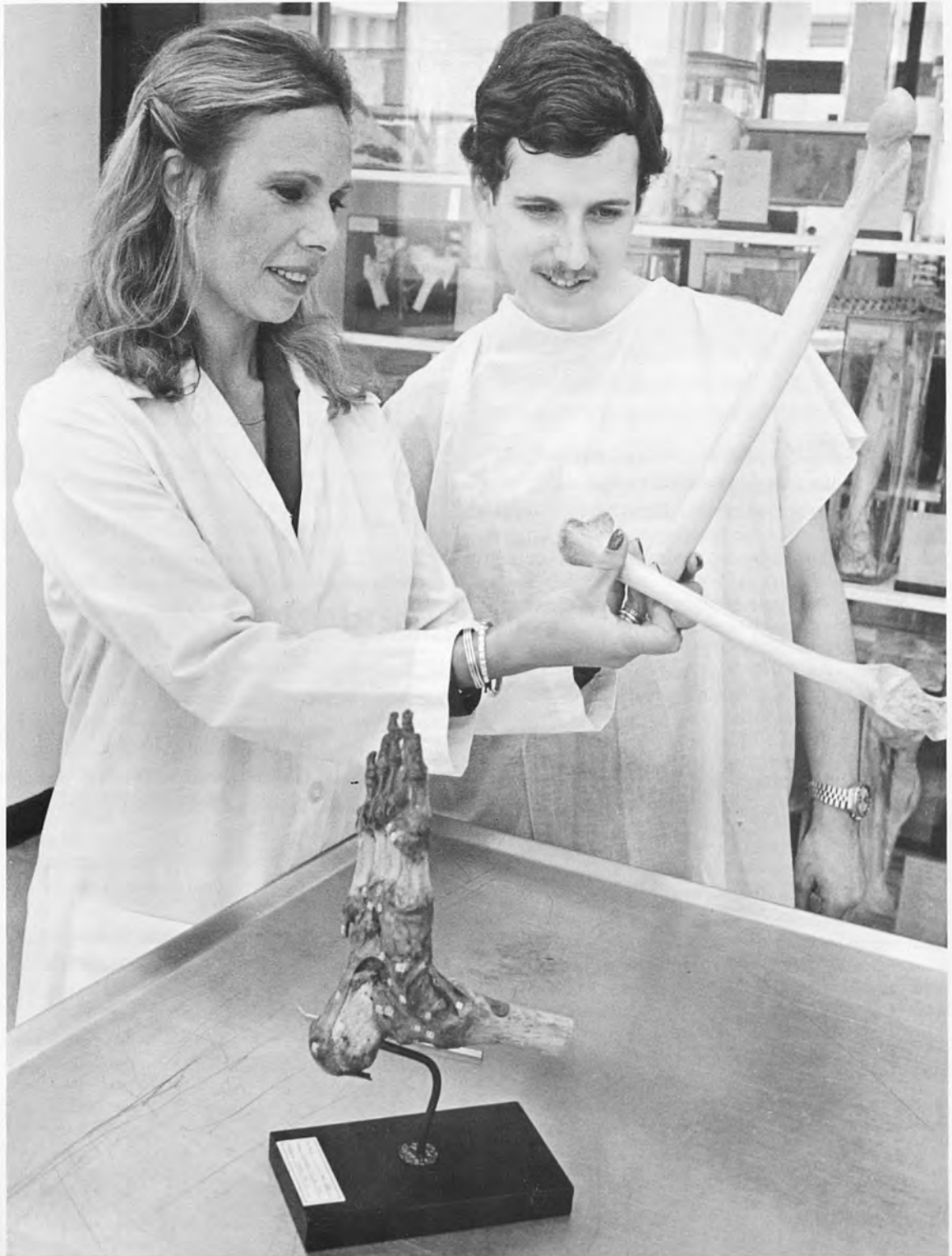
The Alumni Office presents special alumni activities in selected cities across the United States. Each event is tailored to the interests of medical alumni in each metropolitan area. The objectives of this program are to realize maximum private financial support, to enroll the most competent students and residents, and to increase national awareness of the School's preeminence. A committee of volunteers from each area has been organized and trained to assist the School of Medicine in its efforts to increase major gift support and enact other programs to meet the stated objectives.

Special Alumni Programs: Alumni Reunion Days are in May and include a scientific program presented by the Office of Continuing Medical Education, individual class dinners, the Dean's Luncheon, and a Century Club breakfast. The Annual Alumni Dinner Dance honors the 50-year reunion class and the members of the graduating senior class.

Specialty receptions are hosted at many national medical meetings and include the introduction of Medical Center faculty and distinguished guests.

The Washington University Medical Center Alumni Association endeavors to acknowledge the rationale for the School's development objectives, to add sufficiently to the School's endowment, and to sponsor programs that will foster a spirit of fellowship by reacquainting alumni with the continued vitality of their alma mater.

***DEPARTMENT OF
ANATOMY AND
NEUROBIOLOGY***



ANATOMY AND NEUROBIOLOGY

The anatomical sciences are presented in two courses: gross anatomy, offered in the first semester, and microscopic anatomy, offered in the second semester. A third course, neuroscience, is taught in the second semester. Gross anatomy is taught essentially as a laboratory course, with lectures dealing with anatomical principles and with human growth and development. The course in microscopic anatomy consists largely of cell and tissue biology, with laboratory sessions paralleling the lectures in these areas. Neural science is taught mainly from an experimental point of view, with particular emphasis upon the structure and function of nerve cells and synapses and on the organization of selected neural systems. Throughout all three courses attention is paid to the results of recent investigations and to major developments in each field. In addition, the department offers a series of graduate courses which may be taken as electives by students in any of the four years. The department is well equipped for special work in several areas, including gross anatomy, electron microscopy, tissue culture, and all aspects of neurobiology.

FIRST YEAR

Bio 501. Human Anatomy

The course is based largely on the dissection of the human body. Lectures on functional and topographic anatomy emphasize the principles of organization of the various systems of the body. Lectures on developmental anatomy stress organogenesis as an adjunct to understanding the normal and abnormal anatomy. An extensive museum of labeled dissected specimens is housed in the dissecting room for ready reference by students who encounter abnormalities or variations in their dissections. Frequent use of x-ray films, cineradiography films, fresh organs, and cross sections aid in the synthesis of knowledge gained through dissection into clinically useful information. Radiologic anatomy and clinical correlation conferences further aid in this process. Occasional attendance at autopsies is recommended. Credit 6 units.

Bio 506. Microscopic Anatomy

The structure of cells, tissues, and organs is studied with regard to the functional significance of the morphological features. The laboratories consist of the study of prepared slides, of preparations of fresh tissues, and of electron micrographs. A microscope will be provided for each student. Credit 4 units.

Bio 554. Neural Sciences

This course provides a broad introduction to modern neuroscience, including the structure, function and

metabolism of individual neurons, and a comprehensive overview of the structure and function of major systems in the central nervous system. Lectures are supplemented with small group conferences and laboratories. In addition, a wide range of electives (6-10 hours total) provide opportunities for more in-depth study of particular areas (i.e., Learning and Plasticity in the Brain; Diseases of Ion Channels; Peptide Hormones in the Brain). Credit 5 units.

RESEARCH

Bio 590. Research Opportunities

These are offered in the following areas:

Receptor regulation and metabolism of amine and peptide neuromodulators. *Dr. Baenziger*

Growth and differentiation of muscle. *Dr. Bischoff*
Cell biology of developing nerve and muscle cells. *Dr. Bridgman*

Anatomy and physiology of the somatosensory system. *Dr. Burton*

Structure and function of neurotransmitter receptors. *Dr. J. Cohen*

Comparative primate anatomy and human evolution. *Dr. Conroy*

Molecular basis of neurogenesis and synapse formation. *Dr. Fischbach*

Development of neurotransmitter specificity in the brain. *Dr. Gottlieb*

Cellular biochemistry and function of peptide-secreting neurons. *Dr. Krause*

Development of synaptic connections. *Dr. Lichtman*

Central regulation of the sympathetic nervous system and blood pressure control. *Dr. Loewy*

The structure and function of the skin. *Dr. Menton*

Expression and regulation of the genes encoding catecholamine biosynthetic enzymes. *Dr. O'Malley*

Behavior, morphology and biology of living primate populations. *Dr. Phillips-Conroy*

The organization of the limbic forebrain, and its involvement in Alzheimer's Disease. *Dr. Price*

The formation and maintenance of synaptic connections in the mammalian nervous system. *Dr. Purves*

Molecular, genetic and physiological analysis of nervous system mutations affecting membrane electrical properties. *Dr. Salkoff*

Molecular bases of synaptogenesis and retrovirus-mediated gene transfer to neural cells. *Dr. Sanes*

The regulation and function of neuropeptide expression in developing neurons. *Dr. Taghert*



Cellular physiology of posture and movement control. *Dr. Thach*

Axonal transport, cytoskeleton structure, and nerve regeneration. *Dr. Willard*

ELECTIVES

The department offers a number of graduate-level courses which may be taken as electives by medical students. The department participates in the Division of Biology and Biomedical Sciences, which also offers courses relevant to anatomy and neurobiology.

These course descriptions are presented in the section on Biology and Biomedical Sciences.

Bio 5404. Molecular Neurobiology

Bio 5562. Neural Development

Bio 5571. Cellular Neurobiology

Bio 5651. Neural Systems

Bio 567. Advanced Tutorials in Neural Science

Note—The number preceding the course title indicates that the course is offered by the Division of Biology and Biomedical Sciences and carries credit in the Graduate School of Arts and Sciences.

Faculty

Edison Professor of Neurobiology and Head of Department

Gerald D. Fischbach, M.D., Cornell University Medical School, 1965.

Professors Emeriti

Roy R. Peterson, Ph.D., University of Kansas, 1952. (And Lecturer.)

Mildred Trotter, Ph.D., Washington University, 1924; Sc.D. (hon.), Western College, 1956; Sc.D. (hon.), Mount Holyoke College, 1960; Sc.D. (hon.), Washington University, 1980. (See Department of Radiology.)

Professors

Joel E. Brown, Ph.D., Massachusetts Institute of Technology, 1964. (See Department of Ophthalmology and Visual Sciences.)

Harold Burton, Ph.D., University of Wisconsin, 1968. (See Department of Cell Biology and Physiology.)

Theodore J. Cicero, Ph.D., Purdue University, 1968. (See Department of Psychiatry.)

Adolph I. Cohen, Ph.D., Columbia University, 1954. (See Department of Ophthalmology and Visual Sciences.)

Jonathan B. Cohen, Ph.D., Harvard University, 1972.

Glenn C. Conroy, Ph.D., Yale University, 1974. (Also Faculty of Arts and Sciences)

Nigel W. Daw, Ph.D., Johns Hopkins University, 1967. (See Departments of Cell Biology and Physiology and Ophthalmology and Visual Sciences.)

David I. Gottlieb, Ph.D., Washington University, 1971. (See Department of Biochemistry and Molecular Biophysics.)

Stephen M. Highstein, M.D., University of Maryland Medical School, 1965; Ph.D., University of Tokyo, 1976. (See Department of Otolaryngology.)

Arthur D. Loewy, Ph.D.,
University of Wisconsin, 1969.

Joseph L. Price, Ph.D., Oxford
University, 1969.

Dale Purves, M.D., Harvard
University, 1964.

W. Thomas Thach, Jr., M.D.,
Harvard University, 1964. (See
Department of Neurology and
Neurological Surgery.)

Mark B. Willard, Ph.D.,
University of Wisconsin, 1971.
(See Department of Biochemistry
and Molecular Biophysics.)

Thomas A. Woolsey, M.D., Johns
Hopkins University, 1969. (See
Departments of Neurology and
Neurological Surgery and Cell
Biology and Physiology.)

Research Professor

Thomas O. Fox, Ph.D., Princeton
University, 1971.

Associate Professors

E. Richard Bischoff, Ph.D.,
Washington University, 1966.

Mary L. Carlson, Ph.D., Tulane
University, 1967. (See Department
of Psychiatry.)

Ursula W. Goodenough, Ph.D.,
Harvard University, 1969. (Also
Faculty of Arts and Sciences)

Jeff W. Lichtman, Ph.D.,
Washington University, 1980.

Christopher J. Lingle, Ph.D.,
University of Oregon, 1979. (See
Department of Anesthesiology.)

David N. Menton, Ph.D., Brown
University, 1966.

Jane Phillips-Conroy, Ph.D.,
New York University, 1978. (Also
Faculty of Arts and Sciences)

Steven M. Rothman, M.D., State
University of New York, Upstate,
1973. (See Departments of
Pediatrics and Neurology and
Neurological Surgery.)

Joshua R. Sanes, Ph.D., Harvard
University, 1976.

Joseph H. Steinbach, Ph.D.,
University of California, San
Diego, 1973. (See Department of
Anesthesiology.)

Robert H. Waterston, M.D.,
University of Chicago, 1972; Ph.D.,
1972. (See Department of
Genetics.)

Research Associate Professors

Nancy L. Baenziger, Ph.D.,
Washington University, 1971.

Patti M. Nemeth, Ph.D.,
University of California, 1977. (See
Department of Neurology and
Neurological Surgery.)

Assistant Professors

Christine Blazynski, Ph.D.,
Purdue University, 1981. (See
Department of Ophthalmology
and Visual Sciences.)

Paul C. Bridgman, Ph.D., Purdue
University, 1980.

Andreas H. Burkhalter, Ph.D.,
Brain Research Institute, University
of Zurich, 1977. (See Department
of Neurology and Neurological
Surgery.)

James E. Krause, Ph.D.,
University of Wisconsin, Madison,
1980.

Bruce L. Nock, Ph.D., Rutgers
University, 1980. (See Department
of Psychiatry.)

Dennis D. M. O'Leary, Ph.D.,
Washington University, 1983. (See
Department of Neurology and
Neurological Surgery.)

Karen L. O'Malley, Ph.D.,
University of Texas, Austin, 1980.

Gary D. Paige, Ph.D., University
of Chicago, 1980; M.D., 1981. (See
Departments of Neurology and
Neurological Surgery, Ophthalmol-
ogy and Visual Sciences, and
Otolaryngology.)

Steven E. Petersen
(Neuropsychology), Ph.D.,
California Institute of Technology,
1981. (See Department of Neurol-
ogy and Neurological Surgery.)

Lawrence B. Salkoff, Ph.D.,
University of California, Berkeley,
1979. (See Department of
Genetics.)

Antoinette Steinacker, Ph.D.,
University of the Pacific, San
Francisco, 1972. (See Department
of Otolaryngology.)

Paul H. Taghert, Ph.D.,
University of Washington, 1981.

Charles F. Zorumski, M.D.,
St. Louis University, 1978. (See
Departments of Neurology and
Neurological Surgery and
Psychiatry.)

Instructors

David A. Harris, M.D., Ph.D.,
Columbia University, 1983.

Marc H. Schieber, M.D., Ph.D.,
Washington University, 1982.
(See Department of Neurology
and Neurological Surgery.)

***DEPARTMENT OF
ANESTHESIOLOGY***



ANESTHESIOLOGY

According to the American Board of Anesthesiology, this specialty may be described as a practice of medicine which encompasses: (1) the provision of insensibility to pain during surgical, obstetric, therapeutic and diagnostic procedures, and the management of patients so affected; (2) the monitoring and restoration of homeostasis during the perioperative period, as well as homeostasis in the critically ill, injured, or otherwise seriously ill patient; (3) the diagnosis and treatment of painful syndromes; (4) the clinical management and teaching of cardiac and pulmonary resuscitation; (5) the evaluation of respiratory function and application of respiratory therapy in all its forms; (6) the supervision, teaching and evaluation of performance of both medical and paramedical personnel involved in anesthesia, respiratory and critical care; (7) the conduct of research at the clinical and basic science levels to explain and improve the care of patients insofar as physiologic function and the response to drugs are concerned; and (8) the administrative involvement in hospitals, medical schools and outpatient facilities necessary to implement these responsibilities.

With these objectives in mind, this department is dedicated to presenting to the student, as opportunities develop: (1) clinical applications of certain anatomic relationships, e.g., regional nerve blocks; (2) applications of principles of respiratory physiology, e.g., mechanics of ventilation under various circumstances, cardiorespiratory resuscitation; (3) applications of pharmacologic knowledge related to sedative, narcotic, and anesthetic drugs, and to compounds affecting the autonomic nervous system; (4) clinical problems related to acid-base, fluid, and electrolyte balance in surgical patients; and (5) principles underlying the approaches to the emerging concept of "acute medicine."

Anesthesiology bridges the gap between basic science and clinical medicine. It can provide experience in the clinical evaluation of patients and in applied physiology and pharmacology in the acute setting, both in the critical care units, as well as the operating rooms. The clinical instruction in the operating room provides an exposure to the clinical practice of anesthesiology. During anesthesia electives, students are expected to participate in patient management in the intensive care area and/or operating rooms as the elective dictates.

Operating room anesthesiology clerkships are offered for two, four or six week periods. The pharmacology of inhalation, intravenous and local anesthetic drugs is demonstrated by practical application in the operating room. The importance of blood gas determinations in evaluating the efficacy of ventilation is illustrated. Opportunities to provide proficiency and techniques, such as endotracheal intubation, are available. Students are expected to at-

tend the regular anesthesia conferences and seminars. Actual amount of experience is determined primarily by the length of the elective.

A clerkship in clinical research allows the student to participate in the very active program of ongoing clinical research projects involving new anesthetic and analgesic drugs. The student will be expected to participate in the design, data collection, and analysis. Prior approval by Paul F. White, Ph.D., M.D., is mandatory prior to admission to this course.

A four-week elective is also offered in critical care medicine that is designed to familiarize the student with the diagnosis and treatment of the critically-ill surgical patient. This is accomplished by the student becoming an integral part of the intensive care team.

Special electives in basic science research, as it applies to anesthesiology, can be arranged with the principal investigators in the Anesthesiology Research Unit under the direction of Joe Henry Steinbach, Ph.D. These research laboratories have various specific interests but the unit, as a whole, has emphasis on molecular neurobiology. Arrangements for these special electives are made through the specific investigators: Walter A. Boyle III, M.D.; Alex S. Evers, M.D.; Richard Hotchkiss, M.D.; Christopher Lingle, Ph.D.; David Russell, Ph.D.; or Joe Henry Steinbach, Ph.D.



Faculty

Mallinckrodt Professor and Head of Department

William D. Owens, M.D.,
University of Michigan, 1965.

Professors Emeriti

Albert Roos, M.D., University of Gronigen, 1940. (See Department of Cell Biology and Physiology.)

C. R. Stephen, M.D.C.M., McGill University, 1940.

Professors

Bernard C. DeLeo, M.D.,
St. Louis University, 1958.

Leonard W. Fabian, M.D.,
University of Arkansas, 1951.

Demetrios G. Lappas, M.D.,
Aristotelian University, Thessaloniki, Greece, 1961; Ph.D., 1966.

Paul F. White, Ph.D., University of California, 1976; M.D., 1977.

Associate Professor Emeritus

Glenn R. Weygandt, M.D.,
Washington University, 1947.

Associate Professors

Christopher J. Lingle, Ph.D.,
University of Oregon, 1979. (See Department of Anatomy and Neurobiology.)

Necita L. Roa, M.D., University of the Philippines, 1969.

Joseph H. Steinbach, Ph.D.,
University of California, San Diego, 1973. (See Department of Anatomy and Neurobiology.)

Lewis J. Thomas, Jr., M.D.,
Washington University, 1957. (See Department of Cell Biology and Physiology and Biomedical Computer Laboratory.)

Associate Professor (Clinical)

Milton L. Cobb, M.D., University of Texas (Southwestern), 1968.



Assistant Professors

Walter A. Boyle III, M.D.,
University of California, San Francisco, 1977.

David L. Dresner, M.D.,
New York Medical College, 1982.

Alex S. Evers, M.D., New York University, 1978. (See Departments of Medicine and Pharmacology.)

Robert Feinstein, Ph.D.,
University of Michigan, 1968; M.D., Texas A. & M. University, 1982.

Melvin Haber, M.D., New York University, 1963. (See Department of Ophthalmology and Visual Sciences.)

Paul M. Heerdt, M.D., University of Tennessee College of Medicine, 1982; Ph.D., University of Tennessee Graduate School of Medical Sciences, 1985.

Barbel Holtmann, M.D.,
University of Missouri, 1968.

Richard S. Hotchkiss, M.D.,
University of Virginia, 1976.

Terri G. Monk, M.D., University of Nebraska, 1977.

Carl H. Nielsen, M.D.,
Copenhagen Medical School, 1979.

Mehernoor F. Watcha, M.B.B.S.,
Seth G.S. Medical College, 1972. (See Department of Pediatrics.)

Assistant Professors (Clinical)

Nabil Abboud, M.D., St. Joseph's University, 1970. (Jewish Hospital)

Spomenko Bauer, M.D.,
University of Zagreb Faculty of Medicine, 1968. (Jewish Hospital)

Donald J. Dickler, M.D.,
New York University, 1945. (Jewish Hospital)

W. Patrick Gibson, M.D.,
University of Arkansas, 1974.

Gary E. Hirshberg, M.D.,
Hahnemann Medical College, 1972. (See Department of Pediatrics.)

James J. Jenkins, M.D.,
University of North Carolina, 1970. (Jewish Hospital)

M. Emin Kiyancilar, M.D.,
Ain-Shams University, 1970.

Lawrence S. Waldbaum, M.D.,
Washington University, 1973. (Jewish Hospital)

Instructors

Donald E. Arnold, M.D.,
University of Wisconsin School of Medicine, 1984.

William Stephen Bodanske, M.D., Loyola University Stritch School of Medicine, 1975.

Gerold N. Borodach, M.D., Tufts University, 1959.

Michael T. Connor, M.D., Wayne State University, 1974. (See Department of Pediatrics.)

Catherine M. Dunn, M.D., University of Missouri, 1982.

Joel B. Gunter, M.D., University of Oklahoma, 1982. (See Department of Pediatrics.)

Timothy J. Herbst, M.D., Washington University School of Medicine, 1981.

Michael J. Leavell, M.D., University of Kansas, 1984.

John Keith McKelvey, M.D., St. Louis University, 1979.

Alex K. Mills, M.D., University of Manitoba, 1981.

Paul A. Modica, M.D., University of Arizona, 1984.

Amrik S. Narula, M.B.B.S., H. P. Medical College, 1972.

David R. Nicholson, M.D., University of Oklahoma, 1984.

James Vance Park, M.D., Washington University, 1982.

Robert K. Parker, D.O., Kirksville College of Osteopathic Medicine, 1982.

S. Mark Poler, M.D., University of California, San Francisco, 1978.

Charles G. Pond, M.D., St. Louis University School of Medicine, 1980.

Elaine V. Riegle, M.D., University of Iowa College of Medicine, 1987.

David F. Russell, Ph.D., University of California, San Diego, 1977.

James M. Shear, M.D., University of Missouri, Columbia, 1981.

Ellis R. Taylor, M.D., Washington University School of Medicine, 1980.

Rene Tempelhoff, M.D., University of Lyon, France, 1974.

Silvestre A. Tomeldan, M.D., Far Eastern University, 1970. (Jewish Hospital)

Anastasios N. Triantafillou, M.D., University of Athens, Greece, 1970.

Madhav Vinjamuri, M.B.B.S., Medical College of Gulbarga, 1971.

Carey I. Weiss, M.D., University of Illinois, Chicago, 1979.

Karen L. Weiss, M.D., Boston University, 1980.

B. Craig Weldon, M.D., St. Louis University School of Medicine, 1978. (See Department of Pediatrics.)

Samuel Z. Westerfield III, M.D., Columbia University, 1974.

Instructors (Clinical)

Robert C. Engelhardt, M.D., University of Missouri, 1950.

Marshall Fay, M.D., Medical College of Georgia, 1978. (Jewish Hospital)

Joseph M. Forand, M.D., St. Louis University, 1981. (Jewish Hospital)

Barry A. Graff, M.D., St. Louis University, 1976. (Jewish Hospital)

Robert B. Holloway, M.D., Meharry Medical College, 1956. (St. Louis V.A. Hospital)

Akira Iwane, M.D., Nihon University, 1966.

Edgardo Mayuga, M.D., University of Santo Tomas, 1960.

Dorothy S. Perry, M.D., St. Louis University, 1977.

Frank E. Robbins, M.D., Washington University, 1977. (Jewish Hospital)

Gershon Ram Volotzky, M.D., Sackler Medical School, Tel Aviv, Israel, 1974. (Jewish Hospital)

**DEPARTMENT OF
BIOCHEMISTRY
AND MOLECULAR
BIOPHYSICS**



BIOCHEMISTRY AND MOLECULAR BIOPHYSICS

The department offers an advanced course in biochemistry as well as several specialized courses in the major fields of biochemistry. Students of medicine or those in the Graduate School of Arts and Sciences may enroll in these courses or pursue research work under the direction of members of the faculty. The interests of the faculty, listed below, cover many aspects of biochemistry and biophysics with special emphasis on structure/function relationships in proteins, enzymology, metabolic regulation, molecular biology of gene expression and protein biosynthesis, lipid metabolism, and the dynamics of cytoskeletal proteins.

FIRST YEAR

Bio 531. Advanced Biochemistry

Now part of an integrated, first semester, basic life sciences program, the course has been extensively revised to reflect recent advances in the understanding of the regulation of metabolic processes. The course includes segments on macromolecular structure, regulation of energy metabolism, signal transduction, intracellular signals that regulate protein phosphorylation, growth regulation and oncogenes, and the molecules responsible for the interaction of cells with their immediate environment. Lectures in this course have been planned to coordinate with related topics in the concurrent Cell

Biology, Molecular Biology and Genetics courses which, together with Bio 531, form an integrated basic life sciences curriculum. Lectures will be two hours per week throughout the semester. In addition, Biochemistry faculty will participate in Special Topics in Basic Medical Sciences, an original literature and student discussion course, to meet two hours per week for a six-week period during the semester. *Dr. Frazier*

RESEARCH

Bio 590. Research Opportunities

These are offered in the following areas of biochemistry:

Biophysical chemistry of proteins and nucleic acids. Regulatory interactions in macromolecular assemblies. Mutagenic analysis of structure-function relationships in human hemoglobins and gene control systems. *Dr. Ackers*

Genetic engineering of plants to express useful bacterial genes; DNA sequence analysis. *Dr. Barnes*

Molecular biology of yeast; control and fidelity of chromosomal DNA replication. *Dr. Burgers*

Physical studies of enzyme reaction mechanisms. *Dr. Drysdale*

Interactions between cell surface and cytoskeleton. Mobility of molecules in animal cell surfaces. Forces and mechanisms which determine cell shape and cellular viscoelasticity. *Dr. Elson*

Structure and function of macromolecules involved in cell-matrix interaction and growth regulation in vascular cells. *Dr. Frazier*



Actin polymerization and actin binding proteins. Enzyme kinetic theory and enzyme mechanisms. Protein-protein interactions. *Dr. Frieden*

Analysis of cell-specific and region-specific gene expression in the developing and adult intestine using transgenic mice; biosynthesis and compartmentalization of gut proteins; protein myristoylation: mechanisms, effects on protein targeting and cell metabolism. *Dr. Gordon*

Protein chemistry; recombinant DNA-site specific mutagenesis; structure and function of proteins -- collagenases, dehydrogenases, neurotoxins. *Dr. Grant*

Structure of the oligosaccharides of soluble and membrane glycoproteins and their interactions with lectins. *Dr. R. Kornfeld*

Transcriptional regulation of retroviral gene expression. *Dr. Majors*

Mechanism of action of growth factors; phosphorylation of proteins on tyrosine, turnover of phosphatidylinositol. *Dr. Pike*

Membrane lipid synthesis, assembly, and function in eukaryotes. Phospholipid metabolism and signal transduction; intracellular lipid transport; membrane lipid domains. *Dr. Silbert*

Gene structure and protein biosynthesis in eukaryotes. Cloning, translation and compartmentalization of secretory, mitochondrial, and membrane protein. *Dr. Strauss*

ELECTIVES

Descriptions of the elective courses are listed under the Division of Biology and Biomedical Sciences. In some instances, these courses are offered in alternate years. The faculty member in charge of the course should be contacted for specific times.

Bio 5134. Topics in Cell Motility and Cytoskeletal Function

We will consider questions of current interest in the area of cell motility and cytoskeletal function. Each student will choose, from a list of topics, a subject to present to the class. *Dr. Elson*

Bio 5321. Current Topics in Metabolic Regulation

Topics covered include recent discoveries relating to hormone action, including both cell surface and steroid hormones as well as new findings in the area of LDL and cholesterol regulation. Topics change periodically to permit coverage of major recent advances in all aspects of biochemistry. *Dr. Pike*

Bio 5351. Molecular Biology

This course deals with gene regulation in prokaryotes and eukaryotes. Topics covered include: an overview of modern recombinant DNA techniques; the organization, packaging of replication of eukaryotic genomes; transcriptional regulation as revealed by mapping promoter structure/activity relationships; use of transgenic mice to study tissue-specific expression; RNA processing pathways; and the utility of using selected animal viruses as models for understanding mechanisms underlying gene regulation in eukaryotes and viral pathogenesis. *Drs. Gordon, Schlesinger*

Bio 537. Protein Chemistry and Enzyme Mechanisms

The first part of this course covers the characterization and structure of proteins as determined by x-ray crystallography and NMR techniques including site-directed mutagenesis. The second part of the course deals with kinetics and mechanisms of enzymatic reactions. *Dr. Frieden*

Bio 538. Structure and Function of Cell Membranes and Surfaces

A "core component" of the Molecular Biology: Genetics and Biochemistry Program curriculum. This course emphasizes an understanding of the experimental approaches used in elucidating the structure-function relationships of a variety of receptors, transport proteins and membrane enzymes. The role of biomembrane lipids and proteins in signal transduction, cellular compartmentation and cell adhesion is also examined. *Drs. Frazier, Kornfeld*

Bio 5451. Introductory Biophysical Chemistry

This is an elementary introduction to topics in physical chemistry relevant to biophysical studies. Typically, subjects discussed will include thermodynamics, spectroscopy, and molecular transport. This course is not appropriate for students who have taken an undergraduate course in physical chemistry. *Dr. Elson*

Note—The number preceding the course title indicates that the course carries credit in the Graduate School of Arts and Sciences.

Faculty

Wittcoff Professor and Head of Department

Gary K. Ackers, Ph.D., Johns Hopkins University, 1964.

Professors Emeriti

Barbara I. Brown, Ph.D., Yale University, 1950.

David H. Brown, Ph.D., California Institute of Technology, 1948.

Associate Professor Emeritus

William F. Holmes, Ph.D., University of Pennsylvania, 1960. (See Biomedical Computer Laboratory.)

Professors

Jonathan B. Cohen, Ph.D., Harvard College, 1972. (See Department of Anatomy and Neurobiology.)

Thomas F. Deuel, M.D., Columbia University, 1961. (See Department of Medicine.) **George R. Drysdale**, Ph.D., University of Wisconsin, 1952.

George R. Drysdale, Ph.D., University of Wisconsin, 1952.

Sarah C. R. Elgin, Ph.D., California Institute of Technology, 1971. (Also Department of Biology)

Elliot L. Elson, Ph.D., Stanford University, 1966.

William A. Frazier III, Ph.D., Washington University, 1973. (See Departments of Anatomy and Neurobiology and Cell Biology and Physiology.)

Carl Frieden, Ph.D., University of Wisconsin, 1955.

Jeffrey I. Gordon, M.D., University of Chicago, 1973. (See Department of Medicine.)

Rosalind H. Kornfeld, Ph.D., Washington University, 1961. (See Department of Medicine.)

Stuart A. Kornfeld, M.D., Washington University, 1962. (See Department of Medicine.)

Philip W. Majerus, M.D., Washington University, 1961. (See Department of Medicine.)

Garland R. Marshall, Ph.D., Rockefeller University, 1966. (See Department of Pharmacology.)

F. Scott Mathews, Ph.D., University of Minnesota, 1959. (See Department of Cell Biology and Physiology.)

Blake W. Moore, Ph.D., Northwestern University, 1952. (See Department of Psychiatry.)

William R. Sherman, Ph.D., University of Illinois, 1955. (See Department of Psychiatry.)

David F. Silbert, M.D., Harvard University, 1962.

Arnold W. Strauss, M.D., Washington University, 1970. (See Department of Pediatrics.)

Robert E. Thach, Ph.D., Harvard University, 1964. (Also Department of Biology)

Joseph J. Volpe, M.D., Harvard University, 1964. (See Departments of Neurology and Neurological Surgery and Pediatrics.)

James C. Warren, M.D., University of Kansas, 1954; Ph.D., University of Nebraska, 1961. (See Department of Obstetrics and Gynecology.)

Professors (Adjunct)

Luis Glaser, Ph.D., Washington University, 1956.

Howard A. Schneiderman, Ph.D., Harvard University, 1952. (Also Department of Biology)

Associate Professors

Wayne M. Barnes, Ph.D., University of Wisconsin, 1974.

Oscar P. Chilson, Ph.D., Florida State University, 1963. (Also Department of Biology)

David I. Gottlieb, Ph.D., Washington University, 1971. (See Department of Anatomy and Neurobiology.)

Gregory A. Grant, Ph.D., University of Wisconsin, 1975. (See Department of Medicine.)

John J. Jeffrey, Jr., Ph.D., Georgetown University, 1965. (See Department of Medicine.)

Mark B. Willard, Ph.D., University of Wisconsin, 1971. (See Department of Anatomy and Neurobiology.)

Assistant Professors

Peter M.J. Burgers, Ph.D., State University of Leiden, The Netherlands, 1977.

Robert C. Landick, Ph.D., University of Michigan, 1983. (Also Department of Biology)

Ellen Li, Ph.D., M.D., Washington University, 1980. (See Department of Medicine.)

John A. McDonald, Ph.D., Rice University, 1973; M.D., Duke University Medical School, 1973. (See Department of Medicine.)

John E. Majors, Ph.D., Harvard University, 1977.

Linda J. Pike, Ph.D., Duke University, 1980.

J. Evan Sadler, Ph.D., Duke University Medical Center, 1978; M.D., 1979. (See Department of Medicine.)

Douglas M. Tollefsen, Ph.D., M.D., Washington University, 1977. (See Department of Medicine.)

Research Assistant Professors

Jens J. Birktoft, Cand. Scient., University of Copenhagen, Denmark, 1967.

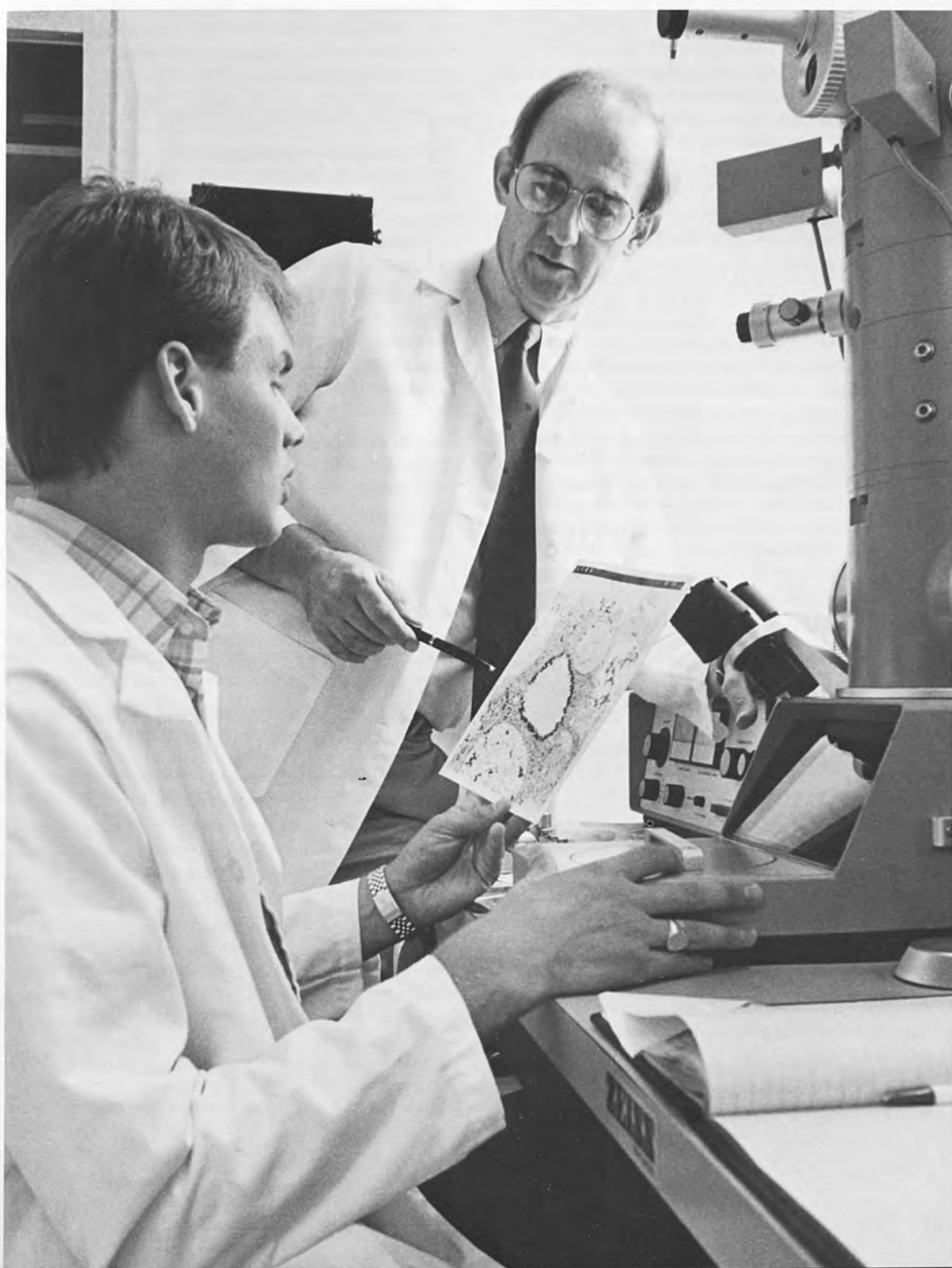
Linda C. Kurz, Ph.D., Washington University, 1973.

Research Instructors

Kenneth Denson, A.B., Occidental College, 1971.

Walter L. Nulty, Jr., M.Sc., Southern Illinois University, 1957.

***DEPARTMENT OF
CELL BIOLOGY
AND
PHYSIOLOGY***



CELL BIOLOGY AND PHYSIOLOGY

The department offers instruction to medical and graduate students. A Cell Biology course in the first semester of the medical curriculum deals with introductory cell physiology, and cellular biophysics. This course is part of an integrated basic life sciences program offered in the first semester. A Physiology course in the second semester of the first year is designed to provide students with a foundation for their further study of clinical and applied physiology. The Department also offers a Neural Sciences course (jointly with the Department of Anatomy and Neurobiology) in the second semester. In addition, advanced courses open to medical and graduate students provide for more detailed study of specific areas of cell biology, physiology, and cellular biophysics.

The following research interests are represented in the Department at the present time: macromolecular structure as studied by x-ray crystallography and other physical methods, the mechanism of action of polypeptide hormones, transport across cell membranes, molecular biology of epithelial transport, reconstitution of intracellular transport including secretion and endocytosis, renal physiology, neurophysiology, contractile activation of muscle, peripheral circulation, respiration, and the application of computer techniques to biological problems. Electron microscopy of nerve and muscle is used to relate structure and function in these tissues.

FIRST YEAR

Bio 502. Physiology

This course integrates and extends the basic principles of cell biology and physiology to the functions of the major organ systems of the body, i.e., muscle, cardiovascular, renal, respiratory, gastrointestinal and endocrine. Credit 6 units.

Bio 5061. Cell Biology

A course covering fundamental aspects of cell organization and physiology. This course is presented concurrently with the Department of Biochemistry and Molecular Biophysics. The goal is to develop an understanding of fundamental cellular processes such as transport, secretion, motility and recognition and to provide a working knowledge of transport across biological barriers, that are relevant to medical physiology. Credit 3 units.

RESEARCH

Bio 590. Research Opportunities

The department offers a variety of research opportunities, particularly in the following areas: macromolecular structure as studied by x-ray crystallography; synthesis and biological activities of polypeptides; membrane transport; lysosomes and intracellular transport; neurophysiology, including nerve membrane, muscle, synaptic transmission, sensory systems (especially auditory and visual), electron microscopy of neural tissues, and biochemical regulation in neurons; circulation; respiration; renal physiology; and the application of computer sciences to physiological problems.

The regulation of receptor-mediated ingestion by professional phagocytes. The mechanisms of signal transduction via a class of molecules known as integrins which act as receptors for extracellular matrix and potentially as organizers of cytoskeletal-membrane interaction in these cells. *Dr. Eric J. Brown*

Developmental regulation of complement biosynthesis in human mononuclear phagocytes. Molecular and cellular mechanisms which account for plasma protein deficiencies, role of mononuclear phagocytes in inflammation and organ development.

Dr. F. Sessions Cole

The role of actin polymerization and actin-binding proteins in cell motility, using a variety of techniques in molecular and cell biology. *Dr. John A. Cooper*

Development of the visual system; effects of visual deprivation on this development; and the function of synaptic transmitters in the visual system.

Dr. Nigel W. Daw

Physiology of cell membranes: kinetics, energetics, and pharmacology of active and passive movements of ions (Na^+ , K^+ , Mg^{2+}) across cell membranes.

Dr. Paul De Weer

Mechanisms of sensory transduction in muscle receptors. *Dr. Y. Fukami*

Cell and molecular biology of the mammalian vacuolar proton pump. *Dr. Stephen L. Gluck*

Development of new methods for visualizing cells and molecules in three dimensions by means of electron microscopy, and for capturing macromolecular mechanisms through rapid freezing techniques. *Dr. John E. Heuser*

Cell biology of insulin-stimulated glucose transport. Cloning and characterization of the major glucose transporter species of insulin-sensitive tissues. Using both site-directed mutagenesis and specific antibodies, studies are being conducted to understand how insulin modifies the transport rate and cellular location of this insulin-regulatable glucose transporter in the cell. *Dr. David E. James*

The suppression of calcium channel activity by opioid peptides in sensory neurons. Two key issues being addressed are: 1) the biochemical link between opioid receptors and Ca channels; 2) heterogeneity of the response of different sensory neuron subsets to opioid peptides.

Dr. Edwin McCleskey

Studies of protein structure and function. Current research interest focuses on proteins involved in electron transfer interactions, oxidation-reduction reactions and recognition. Methods employed include x-ray diffraction, molecular modeling and site-directed mutagenesis. *Dr. F. Scott Matheus*

Identification of environmental factors that influence the developmental phenotype of cells, concentrating mainly on the role of extracellular matrix in initiating differentiation and in maintaining appropriate gene expression in the differentiated phenotype. Role of the cell membrane in recognition of the inductive signals. Characterization of specificity and mechanistic pathway of intracellular signal transduction from receptors at the cell surface to controlling elements on genes. *Dr. Robert Mecham*

Structure and function of cation transport proteins. Molecular biology of the Na, K-ATPase. Identification and characterization of Na K-ATPase isoforms using *in situ* hybridization. *Dr. Robert Mercer*

Patch clamp characterization of ion channels involved in stimulus-secretion coupling in neurons and endocrine cells (e.g. ATP sensitive K^+ channels, voltage-sensitive Ca^{2+} channels, stretch activated cation channels). Fluorescence imaging of cytosolic Ca^{2+} in these cells. *Dr. Stanley Misler*

Molecular biology of the mammalian glucose transporter. Gene structure, biosynthesis and regulation. Expression of transfected cDNA in foreign cells. Mechanism of insertion of proteins into the rough endoplasmic reticulum membrane. *Dr. Mike Mueckler*

Biosynthesis and packaging of peptide hormones investigated in cultured cell lines. The biochemical basis of plasticity in visual cortex through the study of neurotransmitter receptors and proteins such as GAP-43. *Dr. David Parkinson*

Cell-cell and cell-substrate interactions in the early development of mammalian cerebral cortex. Tissue culture assays, light- and electron-microscopic immunohistochemistry, and time-lapse video recording are used to study the role of cell surface and extracellular matrix molecules in neuronal migration and axonal elongation. *Dr. Alan L. Pearlman*

Regulation of protease-antiprotease balance at the cellular level. Effect of mediators of acute inflammation and sex steroid hormones on human hepatic gene expression. *Dr. David Perlmutter*

Transmembrane movements of H ions. Regulation of intracellular pH, using electrophysiological methods. *Dr. Albert Roos*

Models for brain angiogenesis, blood flow and blood-brain barrier. *Dr. Carl M. Rovainen*

Intracellular motility studies using *in vitro* reconstitution of motile processes. Control of vesicle motility in fast axonal transport, endocytosis and exocytosis. Energetic and nanometer scale video analyses of kinesin, dynein, and myosin dependent motility. *Dr. Michael P. Sheetz*

Study of the physiologic basis of human neutrophil function: the role of ion movements in the cellular responses to chemotactic factors and other stimuli. *Dr. Louis Simchowitz*

Receptor-mediated endocytosis and the reconstitution of vesicular transport in broken cell preparations. Regulation of receptor biosynthesis and deployment. Mechanism of receptor internalization and recycling. Physiologic role of receptors which recognize sugar residue on proteins and on other cells. *Dr. Philip D. Stahl*

Computer-based acquisition and analysis of biologic signals via digital signal processing techniques for quantitative biomedical imaging. *Dr. Lewis J. Thomas, Jr.*

Physiology of skeletal muscle and nerve-muscle synapses, especially the role of innervation in determining muscle cell properties. *Dr. Robert S. Wilkinson*

ELECTIVES

Descriptions of the following courses may be found under the Division of Biology and Biomedical Sciences.

Bio 459. Vision

Bio 5062. Central Questions in Cell Biology

Bio 5063. Molecular Cell Biology

Bio 5111. Intracellular Transport of Macromolecules in Animal Cells

Bio 5132. Cell Motility and Cytoskeleton Journal Club

Bio 5134. Topics in Cell Motility and Cytoskeletal Function

Bio 559. Nerve, Muscle, and Synapse

Bio 567. Advanced Tutorials

Note—The number preceding the course title indicates that the course carries credit in the Graduate School of Arts and Sciences. See course descriptions in the Graduate Training section of this catalog.

Faculty

Edward Mallinckrodt, Jr. *Professor and Head of Department*

Philip D. Stahl, Ph.D., West Virginia University, 1967.

Professors Emeriti

Hallowell Davis, M.D., Harvard University, 1922; Sc.D., (hon.), Colby College, 1954; Sc.D., (hon.), Northwestern University, 1962; Sc.D. (hon.), Washington University, 1973. (See Department of Otolaryngology.) (Also Lecturer) (Also Central Institute for the Deaf)

Arthur S. Gilson, Jr., Ph.D., Harvard University, 1924.

Carlton C. Hunt, M.D., Cornell University, 1942. (See Department of Neurology and Neurological Surgery.)

Stanley Lang, Ph.D., University of Chicago, 1953.

Lecturer

Albert Roos, M.D., University of Groningen, 1940. (See Department of Anesthesiology.)

Professors

Joel E. Brown, Ph.D., Massachusetts Institute of Technology, 1964. (See Departments of Ophthalmology and Visual Sciences, and Anatomy and Neurobiology.)

Jerome R. Cox, Jr. (Biomedical Engineering), Sc.D., Massachusetts Institute of Technology, 1954. (See Biomedical Computer Laboratory.) (Also School of Engineering and Applied Science)

Nigel W. Daw, Ph.D., Johns Hopkins University, 1967. (See Department of Ophthalmology and Visual Sciences.)

Paul J. De Weer, M.D., University of Louvain, 1963; Ph.D., University of Maryland, 1969.

William A. Frazier III, Ph.D., Washington University, 1973. (See Department of Biochemistry and Molecular Biophysics.)

John E. Heuser, M.D., Harvard University, 1969.

F. Scott Mathews, Ph.D., University of Minnesota, 1959. (See Department of Biochemistry and Molecular Biophysics.)

Robert P. Mecham, Ph.D., Boston University, 1976. (See Department of Medicine.)

Charles E. Molnar, Sc.D., Massachusetts Institute of Technology, 1966. (Also Computer Systems Laboratory.)

Alan L. Pearlman, M.D., Washington University, 1961. (See Department of Neurology and Neurological Surgery.)

Carl M. Rovainen, Ph.D., Harvard University, 1967.

Michael P. Sheetz, Ph.D., California Institute of Technology, 1972.

Thomas A. Woolsey, M.D., Johns Hopkins University, 1969. (See Departments of Anatomy and Neurobiology and Neurology and Neurological Surgery.)

Associate Professors

Eric J. Brown, M.D., Harvard Medical School, 1975. (See Department of Medicine.)

Harold Burton, Ph.D., University of Wisconsin, 1968. (See Department of Anatomy and Neurobiology.)

F. Sessions Cole, M.D., Yale University School of Medicine, 1973. (See Department of Pediatrics.)

Yasushi Fukami, M.D., Kyoto University, 1957; Ph.D., 1961.

Marc R. Hammerman, M.D., Washington University School of Medicine, 1972. (See Department of Medicine.)

Keith A. Hruska, M.D., Creighton University, 1969. (See Department of Medicine.)

David H. Perlmutter, M.D., St. Louis University School of Medicine, 1978. (See Department of Pediatrics.)

Lewis J. Thomas, Jr., M.D., Washington University, 1957. (See Department of Anesthesiology and Biomedical Computer Laboratory.)

Assistant Professors

John A. Cooper, M.D., Johns Hopkins University, 1982; Ph.D., 1983.

Stephen L. Gluck, M.D., University of California-Los Angeles, 1977. (See Department of Medicine.)

David E. James, Ph.D., University of New South Wales, 1985.

Edwin W. McCleskey, Ph.D., University of Washington, Seattle, 1983.

James G. McNally, Ph.D., University of Chicago, 1983. (See Institute for Biomedical Computing.)

Robert W. Mercer, Ph.D., Syracuse University, 1980.

Stanley Misler, M.D., New York University School of Medicine, 1977; Ph.D., New York University, 1977. (See Department of Medicine.)

Mike Max Mueckler, Ph.D., University of Wisconsin Madison, 1982.

Louis Simchowicz, M.D., New York University School of Medicine, 1970. (See Department of Medicine.)

Thomas H. Steinberg, M.D., New York University School of Medicine, 1978. (See Department of Medicine.)

Robert S. Wilkinson, Ph.D., University of Texas, Austin, 1974.

Research Assistant Professors

Douglas C. Dean, Ph.D., University of Kansas Medical Center, 1981.

David Parkinson, Ph.D., Cambridge University, 1979.

Instructor

Shirley A. Sahrman, Ph.D., Washington University, 1973. (See Department of Neurology and Neurological Surgery and Program in Physical Therapy.)

JAMES S.
McDONNELL
DEPARTMENT OF
GENETICS



GENETICS

The Department of Genetics is at the forefront in developing new methods for physical and genetic mapping of the human genome and for identifying and isolating genes that cause inherited disease or susceptibility to disease. The Department supports a broad program of preclinical and graduate instruction in genetics, with research opportunities ranging from established experimental organisms to humans, and from molecular genetics to population genetics. A significant portion of the first-year course in basic medical sciences is devoted to human and clinical genetics, and particularly to the impact of new genetic technologies on the practice of medicine. Advanced training in clinical genetics and in genetic research is available from the faculty in the Department of Genetics and from geneticists with principal appointments in many other departments within the Medical School.

The Department of Genetics offers a broad range of training opportunities in virtually all major areas of modern genetics. Numbered among the faculty are world leaders in genetic mapping, new methods of DNA manipulation and cloning, developmental genetics, neurogenetics, immunogenetics, human genetics, and population and evolutionary genetics.

In addition to opportunities in human genetics, research opportunities with experimental organisms include genetic studies with the mouse, fruit flies, nematodes, yeast and bacteria.

Many advanced courses and seminars are offered that focus on such subjects as the genetics of inherited disease, gene expression, genetic mapping, molecular genetics, developmental genetics, microbial genetics, immunogenetics, and population and evolutionary genetics. Extraordinary opportunities for research training and experience are available in all of these areas and at all levels. The programs are tailored to meet the needs of medical students, graduate students, and both M.D. and Ph.D. postdoctoral students pursuing advanced training in biomedical research.

FIRST YEAR

Molecular Biology of the Cell

Basic preclinical molecular sciences including genetics and cell and molecular biology. Genetics component consists of lectures and clinical conferences on human and medical genetics with emphasis on common simple mendelian disorders, molecular genetics, genetic linkage studies using restriction fragment length polymorphisms, chromosome abnormalities and clinical cytogenetics,



inherited metabolic disorders, prenatal diagnosis and genetic counseling, immunogenetics, population genetics and genetic epidemiology. *Drs. Hansen, Levine and Staff*

RESEARCH

Bio 590. Research Opportunities

Molecular genetics, gene cloning, genome mapping. *Dr. Maynard Olson* (Genetics), *Dr. Robert Waterston* (Genetics), *Dr. Daniel Hartl* (Genetics), *Dr. H. Mark Johnston* (Genetics), *Dr. Douglas Berg* (Molecular Microbiology), *Dr. Garrett Brodeur* (Pediatrics), *Dr. Timothy Ley* (Surgery), *Dr. Peter Rotwein* (Medicine), *Dr. David Schlessinger* (Molecular Microbiology), *Dr. Richard Todd* (Psychiatry)

Human linkage studies. *Dr. Helen Donis-Keller* (Genetics), *Dr. Daniela Gerhard* (Genetics), *Dr. Philip Green* (Genetics)

Developmental genetics, neurogenetics. *Dr. Robert Waterston* (Genetics), *Dr. Clarissa Cheney* (Genetics), *Dr. Tim Schedl* (Genetics), *Dr. Ian Duncan* (Biology), *Dr. J. Mark Petrash* (Ophthalmology and Visual Sciences), *Dr. Lawrence Salkoff* (Anatomy and Neurobiology)

Immunogenetics, complement. *Dr. R. Paul Levine* (Genetics), *Dr. Donald Shreffler* (Genetics), *Dr. Ted Hansen* (Genetics), *Dr. K. Lynn Cates* (Genetics), *Dr. David Chaplin* (Medicine), *Dr. Susan E. Cullen* (Molecular Microbiology), *Dr. Dennis Loh* (Medicine)

Population and evolutionary genetics. *Dr. Daniel Hartl* (Genetics), *Dr. Howard Ochman* (Genetics), *Dr. Stanley Sawyer* (Mathematics), *Dr. Barbara Schaal* (Biology), *Dr. Alan Templeton* (Biology)

Prenatal diagnosis, genetic counseling, cytogenetics. *Dr. S. Bruce Downton* (Pediatrics), *Dr. James Crane* (Obstetrics and Gynecology), *Dr. Berengere de Martinville* (Pediatrics), *Dr. Michael Watson* (Pediatrics)

Genetic epidemiology, psychiatric genetics, complex genetic disorders. *Dr. C. Robert Cloninger* (Psychiatry), *Dr. Daniela Gerhard* (Genetics), *Dr. Dabeeru C. Rao* (Biostatistics), *Dr. Theodore Reich* (Psychiatry), *Dr. Brian Suarez* (Psychiatry)

ELECTIVES

Bio 5244. Topics in Gene Expression

Critical reviews of current theories and research in molecular mechanisms of gene regulation, particularly in eukaryotes. *Dr. Waterston and Staff*

Bio 5281. Developmental Genetics

Genetics control of development including sex determination, pattern formation, determination of cell fate, analysis of cell lineages and regulation of tissue-specific genes. Emphasis is on the use of genetics as a research strategy to investigate these phenomena in experimental organisms. *Dr. Waterston and Staff*

Bio 548. Nucleic Acids and Protein Biosynthesis

Note—The number preceding the course title indicates that the course carries credit in the Graduate School of Arts and Sciences.

Faculty

James S. McDonnell Professor of Genetics and Head of Department

Daniel L. Hartl, Ph.D., University of Wisconsin, 1968. (Also Faculty of Arts and Sciences)

Professors

Douglas E. Berg, Ph.D., University of Washington, 1969. (See Department of Molecular Microbiology.)

C. Robert Cloninger, M.D., Washington University, 1970; M.D. (hon.), Umea University Sweden, 1983. (See Department of Psychiatry.)

Susan E. Cullen, Ph.D., Albert Einstein College, 1971. (See Department of Molecular Microbiology.)

Helen Donis-Keller, Ph.D., Harvard University, 1979.

George B. Johnson, Ph.D., Stanford University, 1972. (Also Faculty of Arts and Sciences)

R. Paul Levine, Ph.D., University of California, Los Angeles, 1951.

Maynard V. Olson, Ph.D., Stanford University, 1970.

Dabeeru C. Rao, Ph.D., Indian Statistical Institute, 1971. (See Department of Psychiatry and Division of Biostatistics.)

Theodore Reich, M.D., McGill University, 1963. (See Department of Psychiatry.)

Stanley Sawyer, Ph.D., California Institute of Technology, 1964. (See Division of Biostatistics.) (Also Faculty of Arts and Sciences)

David Schlessinger, Ph.D., Harvard University, 1961. (See Departments of Medicine and Molecular Microbiology.)

Donald C. Shreffler, Ph.D., California Institute of Technology, 1962.

Alan R. Templeton, Ph.D., University of Michigan, 1972. (Also Faculty of Arts and Sciences)

Robert H. Waterston, M.D., University of Chicago, 1972; Ph.D., 1972. (See Department of Anatomy and Neurobiology.)

Associate Professors

Garrett M. Brodeur, M.D.,
Washington University, 1975.
(See Department of Pediatrics.)

James P. Crane, M.D., Indiana
University, 1970. (See Department
of Obstetrics and
Gynecology.)

Ted H. Hansen, Ph.D.,
University of Michigan, 1975.

Dennis Loh, M.D., Harvard
Medical School, 1977. (See
Departments of Medicine and
Molecular Microbiology.)

Barbara A. Schaal, Ph.D., Yale
University, 1974. (Also Faculty
of Arts and Sciences)

Brian K. Suarez, Ph.D.,
University of California, Los
Angeles, 1974. (See Department
of Psychiatry.)

Assistant Professors

David D. Chaplin, M.D.,
Ph.D., Washington University,
1980. (See Departments of
Medicine and Molecular
Microbiology.)

Clarissa M. Cheney, Ph.D.,
University of Pennsylvania,
1979.

Berengere M. de Martinville,
M.D., Lyon Medical School,
France, 1973. (See Department
of Pediatrics.)

S. Bruce Dowton, B.M., B.S.,
University of New South Wales,
1980. (See Department of
Pediatrics.)

Ian W. Duncan, Ph.D.,
University of Washington, 1978.
(Also Faculty of Arts and
Sciences)

Philip P. Green, Ph.D.,
University of California,
Berkeley, 1976.

Daniela S. Gerhard, Ph.D.,
Cornell University, 1982.

H. Mark Johnston, Ph.D.,
University of California,
Berkeley, 1980.

Timothy J. Ley, M.D.,
Washington University, 1978.
(See Department of Medicine.)

J. Mark Petrash, Ph.D., Univer-
sity of Texas at Galveston,
1981. (See Department of Oph-
thalmology and Visual Scien-
ces.)

Peter S. Rotwein, M.D., Albert
Einstein College of Medicine,
1975. (See Department of
Medicine.)

Lawrence B. Salkoff, Ph.D.,
University of California,
Berkeley, 1979. (See Depart-
ment of Anatomy and
Neurobiology.)

Tim B. Schedl, Ph.D.,
University of Wisconsin, 1984.

Richard D. Todd, Ph.D.,
University of Texas, Dallas,
1977; M.D., University of Texas,
San Antonio, 1981. (See Depart-
ment of Psychiatry.)

Michael S. Watson, Ph.D.,
University of Alabama, 1981.
(See Department of Pediatrics.)

Research Assistant Professors

Kathryn Lynn Cates, M.D.,
Northwestern University, 1973.

Vera Hauptfeld, Ph.D.,
Charles University, 1968.

Howard Ochman, Ph.D.,
University of Rochester, 1984.

Adjunct Assistant Professor

Gregory F. Hollis, Ph.D.,
Johns Hopkins University, 1980.

Instructor

Janet M. Connolly, Ph.D.,
George Washington University,
1979.

JOHN MILLIKEN
DEPARTMENT OF
MEDICINE



MEDICINE

The general medicine teaching services of the department are located at Barnes Hospital, Jewish Hospital, and Veterans Hospital (John Cochran Division) under the following directors:

Barnes Hospital, *Dr. Kipnis*

House Staff Training Program, *Dr. Hammerman*

Jewish Hospital, *Dr. Senior*

House Staff Training Program, *Dr. Lefrak*

Veterans Hospital, *Dr. Chase*

In addition, for the purposes of both teaching and research, the Department of Medicine is divided into specialty divisions at Barnes Hospital and Jewish Hospital under the following directors:

Bone and Mineral Diseases, *Dr. Avioli*

Cardiovascular Diseases, *Drs. Sobel, Lange*

Dermatology, *Drs. Eisen, Welgus*

Endocrinology and Metabolism, *Drs. Cryer, Schonfeld*

Gastroenterology, *Drs. Alpers, Stenson*

Hematology-Oncology, *Drs. Majerus, S. Kornfeld, T. Deuel*

Immunology and Allergy Diseases, *Dr. Lob*

Infectious Diseases, *Drs. Medoff, Brown, Little*

Laboratory Medicine, *Dr. J. M. McDonald*

Renal Diseases, *Drs. Klabr, Hruska*

Respiratory and Critical Care Division,
Drs. J. A. McDonald, Senior

Rheumatology, *Drs. Atkinson, Schwartz*

Instruction in Medicine is provided during all four years of the medical curriculum, beginning with human genetics and an introductory course in the first year. Teaching in the second year has two main objectives: the correlation of the basic sciences with clinical aspects of disease and training in the technical methods of physical examination and laboratory diagnosis. By the beginning of the third year, the student is prepared for supervised clinical study of individual patients. A clinical clerkship of 12 weeks, divided into two six-week periods, is served by third-year students on one of the medical services supervised by the department. In the final year, students may elect a subinternship in general medicine or select any of a series of elective courses offered in the various medical subspecialties.

FIRST YEAR

Topics in Clinical Medicine

This interdepartmental course is highly coordinated with Medicine in Modern Society. Students select



topics of interest for in-depth study initiated by discussions in a small-group seminar format. Development of topics includes input from a broad range of disciplines, including law, sociology, philosophy, ethics, history, communications, economics, as well as the biological and medical sciences.

Dr. Tuteur and Staff

SECOND YEAR

Teaching by the Department of Medicine is designed to (1) prepare students for the transition from the preclinical sciences to the study of the sick patient at the bedside, (2) help them analyze the manifestations of disease in terms of the altered mechanisms responsible for these manifestations, and (3) introduce them to the techniques of examination which are used regularly on all clinical services with the beginning of the third-year clerkships. This instruction is at times undertaken jointly with members of other clinical departments, and is coordinated when practicable with subject matter presented by the Department of Pathology.

Pathophysiology

Selected topics in clinical medicine are discussed in detail to illustrate the application of biochemical, physiological, and anatomical information in the understanding of pathological states. Cardiovascular and renal, neurological, gastrointestinal, hematological, metabolic, nutritional, and developmental diseases are reviewed by an interdepartmental faculty. Emphasis is placed on the use of fundamental information in approaching clinical problems as a way of thinking in preparation for a lifetime of medicine, during which much new information will constantly be acquired. *Department of Medicine Staff*

Preparation for Clinical Medicine

PCM is a multidisciplinary, clinical data collection and problem solving course designed to prepare students for meaningful participation in third year clinical activities as a member of the health care team. Centrally coordinated, the clinical aspects of Human Sexuality, Psychiatry, Pediatrics, Surgery, Ophthalmology, Otolaryngology, Obstetrics, Gynecology, Radiology, Neurology, and Medical Sociology are integrated to aid the students' development of skills in the physician-patient relationships, clinical data collection and problem solving. A variety of instructional formats are used including lecture, demonstration, film and video tape, small group discussions, supervised peer examination (supervised sessions where students perform portions of the physical exam on each other), evaluation of clinical subjects simulating patient care situations, and computer assisted instruction as well as supervised interaction with patients in both the ambulatory and hospital setting. Data collection, data processing, and problem solving are the desired skills; a view that the patient is a social being interacting with illness, family, environment, and physician is the desired attitude.

Student assessment includes two written examinations, term paper, and evaluation by clinical subject of student's clinical interaction and data handling skills. During the 269 hours of instruction, the mean student-faculty ratio is less than 6:1.

Dr. Tuteur and Staff

THIRD YEAR

General Medicine

Supervised study of patients on the medical nursing divisions of Barnes Hospital (both Blue and Red), Jewish Hospital, and St. Louis Veterans Administration Hospital. Students are assigned in rotation as clinical clerks to the patients admitted to these services. Teaching is provided by attending physicians, house officers, consultants, and at regularly scheduled conferences. Formal instruction will be given in medical therapeutics during the clerkship. Students serve for six weeks on two of the five services. *Drs. Chase, Kipnis, Senior and Staff*

Clinical Pathological Conference

Abstracts of the clinical records of patients upon whom postmortem examinations have been performed are presented in advance to members of the Third and Fourth Year Classes and to members of the medical staff. At each conference the diagnosis is discussed in detail by the clinical staff before the anatomical findings are presented by the pathologists. *Dr. Kipnis and Medical Staff, Dr. Kissane and Pathology Staff*

FOURTH YEAR ELECTIVES

Medical Subinternship

Medical subinternships, in multiples of six weeks, are offered to a limited number of students on the following medical services: Barnes Hospital Blue and Red Services, Jewish Hospital and St. Louis Veterans Administration Hospital. Duties and responsibilities, including nights on call, will be those of an intern, with the proviso that requirements of Missouri state law must be met (e.g., orders must be countersigned by a licensed physician, etc.). The workload will be lighter than that for interns to insure ample time for reading about patients. Instruction and supervision will be provided by the appropriate chief of service, attending physicians, consultants, and house officers. Attendance at scheduled teaching conferences is required. The subinternship should be especially valuable to students who plan to take straight medical internships and to those who plan to go directly into a specialty residency program without first serving an internship of any kind (e.g., neurology, psychiatry, etc.). *Drs. Chase, Kipnis, Senior and Staff*

Clinical Pathological Conference

Thursday, 12-1 p.m., September to June.

Dr. Kipnis and Medical Staff,

Dr. Kissane and Pathology Staff

Arthritic and Rheumatic Diseases

(A) Clinical Rheumatology. Barnes, Jewish, and VA, four weeks, all day. Students will participate in consultative service and clinic and inpatient practices. Laboratory experience also available.

Dr. Atkinson and Staff

(B) Research.

1. Studies related to complement deficiency states and immunogenetics of complement proteins in humans and animals and biosynthesis, genetics and structure-function relationships of complement receptors and complement regulatory proteins.

Dr. Atkinson

2. Projects offered in analyzing molecular structure and regulation of expression of the human and murine fibronectin receptor expressed on phagocytic cells. *Dr. Holers*

3. Structure of the human major histocompatibility complex (HLA) antigens. Mechanisms of HLA and disease association. *Dr. Schwartz*

4. Students participate in research procedures which include quantitation of the cell functions of chemotaxis, phagocytosis, and lysosomal enzyme release, isolation of cell receptors for chemotactic factors and purification of enzymes involved in neutrophil activation. *Dr. Spilberg*

Cardiovascular Disease

(A) Clinical Cardiology. Barnes Hospital, six weeks, all day. Students will participate as members of Cardiovascular Division clinical service, on the Cardiology Consultation team and in the Cardiac Diagnostic Laboratory. Particular emphasis will be placed on clinical diagnosis, electrocardiography and the non-invasive techniques. *Dr. Geltman and Staff*

(B) Clinical Cardiology. St. Luke's Hospital West, six weeks, all day. Students are assigned to Cardiology Division in the cardiology intensive care unit, heart station, echo laboratory, nuclear cardiology laboratory, and catheterization laboratory. *Drs. R. Paine, G. Clark, S. Brodarick, D. Bauwens, and S. Gouda*

(C) Clinical Cardiology. Jewish Hospital, six weeks, all day. Students have experience in seeing patients on the cardiology consult service and cardiac catheterization service, reading electrocardiograms, and participating in activities of the Coronary Care Unit. In addition, students may observe procedures in the cardiac catheterization laboratory. *Drs. Lange, Kleiger, Krone, and Staff*

(D) Cardiac Catheterization and Hemodynamics. Highly specialized elective. Four weeks. Students will attend cardiac catheterization procedures and conferences; will perform complete "workups" of patients in preparation for catheterization, etc.; and will observe all hemodynamic and angiographic procedures. *Dr. Ludbrook and Staff*

(E) Electrocardiography. Jewish Hospital. Course designed to give the student familiarity with concepts involved in the interpretation of electrocardiography. *Dr. Ruffly*

(F) Cardiac Arrhythmias and Clinical Electrophysiology. Jewish Hospital. Provides the student with exposure and teaching in the diagnosis and treatment of complex rhythm disturbances. *Dr. Ruffly*

(G) Cardiology/CCU. Jewish Hospital. Students will be introduced to cardiac graphics, electrocardiography, echocardiograms, and other non-invasive tests, then rotate through CCU as a subintern. Students are expected to perform initial evaluation and formulate management plan under resident's guidance, make brief oral presentations to CCU attendings. Night call every third night. *Dr. M. Rich*

(H) Research. Minimum of 12 weeks, all day.
1. Characterization of myocardial blood flow and metabolism during ischemia and reperfusion. *Dr. S. Bergmann*



2. Ultrasonic characterization of atherosclerotic plaque. Quantitative techniques are being developed to assess the composition of an atherosclerotic plaque utilizing ultrasonic methods. *Dr. Barzilai*

3. Characterization of biochemical changes responsible for post-translational modification of MM and MB creatinine kinase into isoforms. *Dr. Billadello*

4. Delineation of mechanisms responsible for clinical arrhythmias, identification of patients at risk for developing sudden cardiac death, evaluation of antiarrhythmic agents and pacing devices. *Dr. Cain*

5. Delineation of biochemical and electrophysiologic mechanisms responsible for arrhythmogenesis. *Dr. Corr*

6. (a) Clinical Elective: Performance and interpretation of exercise training measurement of oxygen uptake and cardiac output. Management of patients undergoing exercise training. (b) Research Elective: Physiology adaptations to exercise training in ischemic heart disease and effect of exercise training on age-related deterioration in cardiovascular function. *Dr. Ehsani*

7. Investigation of basic mechanisms of atherogenesis and cardiomyopathy. Focus is on vascular intracellular metabolism of cholesterol regulation of enzymes. Jewish Hospital. *Dr. Lange*

8. Hemodynamics, myocardial mechanics, and ventricular function (cardiac catheterization). *Dr. Ludbrook*

9. Ultrasonic assessment of cardiac metabolism. *Dr. Perez*

10. Detection, quantification, and assessment of the mediation of myocardial ischemic injury. *Dr. Sobel*

Dermatology

(A) Clinical Clerkship. Students participate in outpatient care. Stress is placed on the dermatologic variations normally encountered, identification of common skin diseases, dermatologic clues to systemic disease, etc. Instruction is given in cutaneous histopathology and clinical mycology. *Dr. Eisen and Staff*

(B) Research. Minimum of 12 weeks, all day.

1. Role of metalloproteases in extracellular matrix (connective tissue) degradation and tumorigenesis. *Drs. Eisen, Goldberg, Jeffrey, and Seltzer*

2. Regulation of extracellular matrix gene expression. Role of proteases in inflammation, fibrosis and tumorigenesis. *Dr. G. Goldberg*

3. Cellular and molecular biology of the regulation of collagenase expression and activation in the pregnant and post-partum mammalian uterus. *Dr. Jeffrey*

4. Biochemical studies on the control of cellular differentiation of the medically important systemic mycotic agents in particular *Histoplasma capsulatum*. *Dr. Kobayashi*

5. Development and use of monoclonal antibodies to isoenzymes. *Dr. Kupper*

6. Mechanisms by which metabolites of arachidonic acid produce the erythema observed after sunburn are being examined. Current emphasis is on the role of mast cell products in stimulating keratinocyte prostaglandin synthesis after ultraviolet light exposure, and the mechanism by which this stimulation occurs. *Dr. Pentland*

Gastroenterology

(A) Clinical Gastroenterology. Four weeks, all day. Students participate in the study of patients with a spectrum of digestive diseases, have responsibility for patients on whom consultations have been requested, observe biopsy, endoscopic and intubation techniques, and participate in the conferences and clinics run by the Division. *Dr. Zuckerman*

(B) Research. Minimum of 12 weeks, all day.

1. Synthesis and secretion of intestinal proteins; regulation by dietary and hormonal factors *in vivo* and in cultured intestinal cells. Emphasis will be on unique secretory pathways of alkaline phosphatase and cobalamin binding proteins. *Dr. Alpers*

2. Clinical applied research on viral hepatitis. Emphasis is placed on applying current immunological methodology to clinical and investigative studies of

important and yet unanswered problems in the field of hepatitis, both acute and chronic. *Dr. Perrillo*

3. Human cellular immunology; effect of cytokines and peptides on normal human peripheral blood, tonsillar and splenic B cells; immunoregulation of hepatitis B virus using B and T cell lines and clones from patients with acute and chronic hepatitis. *Dr. Peters*

General Internal Medicine

(A) Clerkship in Primary Care in General Internal Medicine is designed to provide the student with firsthand experience in general internal medicine practice in a model ambulatory care setting, the Health Key Medical Group of St. Louis. The major component of the clerkship is direct patient care under the supervision of senior internists who are members of the group. *Dr. Scott Anderson and Staff*

(B) Clerkship in General Internal Medicine in a small community without medical subspecialists (Keokuk, IA). Emphasis during preceptorship will be on ambulatory care. Students will work with three internists. Exposure will include consultations from general surgeons and family practitioners and other responsibilities of the general internal medicine group including treadmill exercise testing, echocardiograms, Holter Monitor analysis and interpretation, etc. Students will also have direct inpatient care responsibility including evaluation and treatment of admissions to the CCU. *Drs. Austin, Davis and Hakes*

(C) Medicine Clinic Outpatient Experience. Four half-day sessions in General Internal Medicine and two half-day sessions in a Medicine Specialty. A new clinic patients will be assigned to each student for workup, followed by presentation to the Attending Physician and Medical Resident/Fellow who will follow the patient after the student has finished the rotation. Discussion of each case will include diagnosis, further workup, therapy and follow-up care. *Dr. Levitt*

Geriatric Medicine

Clinical Geriatrics. Six weeks, all day. Students will make rounds at a nursing facility, participate in a clinic and outpatient assessment clinic. Attendance at research and clinical conferences and teaching rounds in geriatric medicine required. *Drs. Peck, Binder, Birge, Davis, and Staff*

Hematology and Oncology

(A) Clinical Hematology and Oncology. Six weeks, all day. Students receive intensive instruction in morphology, specialized diagnostic techniques, and management of patients with hematologic and oncologic disorders. Two separate clerkships are offered. *Drs. S. Kornfeld, Majerus*

(B) Hematology/Oncology; Experimental Oncology. Activities include work-up, evaluation and treatment primarily of inpatients undergoing experimental chemotherapy for hematologic malignancy and selected solid tumors. Emphasis placed on attempts to develop curative therapy utilizing bone marrow transplantation. *Dr. G. Herzig*

(C) Clinical Oncology. Cochran VA Hospital. Four weeks, all day. Students receive major exposure to management of non-small cell and small cell lung cancer and of carcinoma of the colon, prostate, head, and neck. General oncological topics such as pain management, hypercalcemia of malignancy, malignant effusions, and neurooncology will be treated. *Drs. Abbey, Hickman*

(D) Clinical Hematology/Medical Oncology Consultation Service. Jewish Hospital. Six weeks, all day. Students will participate on the inpatient consultation service but equal emphasis will be given to the care of outpatients with cancer and hematologic disease. Specialized training in the management of patients with breast cancer and hematologic malignancies will be provided by the Marilyn Fixman Breast Center and Lymphoma Consultation Service. Emphasis will be given to principles of cancer management and to supportive, palliative treatment of symptomatic patients. *Dr. A. Lyss*

(E) Research. Minimum of 12 weeks, all day.

1. Biochemistry and mechanisms of action of the platelet-derived growth factor (PDGF). *Dr. T. Deuel*
2. Biochemistry of mammalian cell membranes. *Drs. R. Kornfeld, S. Kornfeld*
3. Biochemistry of platelets, regulation of lipid metabolism in tissue culture; mechanism of platelet thrombus formation. *Dr. Majerus*
4. Molecular biology of hormonally regulated genes; characterization of the thial protease gene family. *Dr. Rogers*
5. Biochemical studies of interactions of plasma protease inhibitors with coagulation proteases. *Dr. Tollefsen*

Hypertension

Research. Individualized research project and/or participation in a community hypertension program. *Dr. Perry*

Immunology

(A) Allergy and Clinical Immunology. Students will participate in the allergy consult service at Barnes and Jewish Hospitals. They will be primary consult on a team with an allergy fellow. In addition, they will participate in other on-going teaching activities in the division. *Dr. H.J. Wedner and Staff*

(B) Research. Minimum of 12 weeks, full-time.

1. Molecular biology of antigen specific T-cell receptor. *Dr. D. Lob*
2. Molecular biology of IL-1, steroid 25-hydroxylase and complement genes. *Dr. D. Chaplin*
3. Biochemistry and molecular biology of molecules important in immediate hypersensitivity. *Dr. C. Parker*
4. Protein phosphorylation in activated T-cells. *Dr. H.J. Wedner*
5. Bovine IGG and human immunologic responses and disease. *Dr. A. Kulczycki*

Infectious Disease

(A) Clinical Infectious Diseases. Study of patients with infectious diseases. Barnes Hospital, six weeks, all day. *Dr. Medoff*

(B) Research.

1. The molecular biology of varicella-zoster virus. Varicella-zoster virus infection, latency, and oncogenicity. *Dr. Gelb*
2. Research. Minimum of 12 weeks, all day. The biology of mouse macrophage clones in culture: monokine secretion, cell activation, antimicrobial activity. *Dr. Little*
3. Effective therapy for fungal infections, control of membrane permeability of fungi, normal and transformed animal cells, alteration and control of immunologic response to infection and tumors, drug studies on bacterial pathogens. *Dr. Medoff*

Laboratory Medicine

(A) Clinical Laboratory Medicine. Elective is designed to teach the student how the vast array of clinical assays are used in the diagnosis of disease and how the tests are actually performed in the clinical laboratory. *Dr. McDonald*

(B) Research.

1. Studies on the control of cellular differentiation of the medically important systemic mycotic agents in particular *Histoplasma capsulatum*. *Dr. Kobayashi*
2. Drug action and resistance in *Plasmodium falciparum*, red cell deformability and parasite growth, epidemiology of nosocomial infection. *Dr. Krogstad*
3. Development and use of monoclonal antibodies to isoenzymes. *Dr. Ladenson*
4. Investigation of a group of membrane proteins that utilize a novel glycopospholipid structure containing phosphatidylinositol as their mode of

membrane anchoring. Research projects involve DNA cloning and sequencing, site-directed mutagenesis, and transfection to study the structure and function of this class of membrane proteins.

Dr. Lublin

5. Laboratory interested in changes in the pattern of gene expression which occur during development of mammalian nervous system. Attention focused on tropic hormone, nerve growth factor (NGF), an agent which is critical for the survival and differentiation of sympathetic neurons. *Dr. Milbrandt*

6. Research focuses upon the cellular mechanism of insulin action and the intracellular mechanism of Ca^{2+} homeostasis and the role of intracellular Ca^{2+} , calmodulin and protein kinase C in metabolic regulation. *Dr. McDonald*

7. Study of restriction of IgG subclasses expression and B lymphocyte subpopulation within germinal center. *Dr. Nabm*

8. Analytical techniques and theoretical concepts underlying the field of medical decision analysis are investigated. *Dr. Parvin*

9. Research is aimed at defining the mechanisms of cell-cell and cell-substrate adhesion as manifest by the blood platelet. *Dr. Santoro*

10. Phospholipid-derived mediators and insulin secretion. The study of the process of glucose-induced insulin secretion by isolated pancreatic islets from rat and man. Focus on involvement of phospholipid-derived mediators in this signal transduction process. Involves gas chromatography-mass spectrometry. *Dr. Turk*

Metabolism and Endocrinology

(A) Clinical Clerkship. Students see inpatients and outpatients with endocrine and metabolic disease and participate in the rounds and conferences of the Metabolism Division. *Dr. Cryer and Staff*

(B) Bone and Mineral Metabolism. Jewish Hospital. Designed to acquaint students with clinical, radiological, and pathological manifestations of generalized disorders of endocrinology and of the skeleton and to expose them to current concepts of therapy. *Drs. Avioli, S. Birge, Chase, and Whyte*

(C) Research. Minimum of 12 weeks, all day.

1. Research activities involve analysis of age-related changes on membrane-transport activities, alterations in cellular metabolism, calcium control and energy utilization. *Dr. Avioli*



2. Studies of the physiology and pathophysiology of metabolic regulation in normal humans and patients with diabetes mellitus. *Dr. Cryer*

3. Research on the regulation of growth hormone and prolactin, investigations of biological action and receptor binding of somatomedin, clinical disorders of growth. *Dr. Daughaday*

4. Studies characterizing mechanisms by which hormones transmit "signals" in cells. Studies characterizing the role of insulin-like growth factors (somatomedins) in renal cell growth and hypertrophy. *Dr. M. Hammerman*

5. Regulation of plasma and body cholesterol levels studied in patients with atherosclerosis and hyperlipidemia. Lipoprotein receptor structure, function and modification is investigated in normal and mutant cultured human cells. *Dr. Ostlund*

6. Studies of genetic susceptibility to diabetes in man and experimental animal models through recombinant DNA techniques. *Dr. Permutt*

Pharmacology/Medicine

Role of endogenous eicosanoids on cellular transport and renal vascular tissue. Phospholipid and complex lipid metabolism in relation to renal injury. Role of inositol phospholipids in renal cell function.

Dr. Morrison

Pulmonary Disease and Function

(A) Medical Aspects of Pulmonary Disease. A full-time elective, periods one through eight. Elective offered at both Barnes and Cochran V.A. Hospital.

Drs. C. Daughaday, McDonald, Pierce, Tuteur, and Staff

(B) Pulmonary Medicine. Six weeks. Students will work up patients and participate in teaching conferences and work rounds. Jewish Hospital.

Drs. Senior, Lefrak, and Staff

(C) Medical/Respiratory Intensive Care (4 weeks). Offered as an opportunity to gain additional experience in acute, primary care medicine. Students considering this elective will be expected to have already completed their Medicine Subinternship. *Dr. Schuster*

(D) Intensive Care Medicine (4 weeks). Patient care responsibility, night call, conferences and attending rounds. Medical Intensive Care Unit at Jewish Hospital. *Dr. Lefrak*

(E) Research Electives.

1. Students will be introduced to contemporary methods to study the interaction of cells with extracellular matrix molecules important in wound healing and repair and embryogenesis. *Dr. McDonald*

2. Positron emission tomographic studies of acute lung injury. Students will be introduced to large animal models of acute lung injury and techniques involving positron emission tomography, nuclear medicine and pulmonary physiology. *Dr. Schuster*

Renal Disease

(A) Clinical Nephrology. Barnes Hospital, six weeks, all day. Study of patients with renal disease and electrolyte disorders. *Drs. Klabr, Slatopolsky and Staff*

(B) Clinical Nephrology. Jewish Hospital. Students will be provided opportunity to evaluate patients on the renal consultant service, participate in daily clinical nephrology rounds, and participate in combined rounds. *Dr. Hruska*

(C) Mixed Clinical and Research Electives.

1. Clinical and metabolic studies in patients with end stage renal disease and hemodialysis patients. *Dr. Delmez*

2. Studies on physiology of isolated renal tubular segments with an emphasis on acid-base metabolism and influence of pH on transport. *Dr. Lee Hamm*

3. Cellular mechanisms of parathyroid hormone action. The student will participate in studies analyzing the control of cellular phosphorus and calcium transport by parathyroid hormone. *Dr. Hruska*

4. Mechanisms involved in progression of renal disease. Methodology to assess renal function and prevent progression of renal disease in experimental animal models. *Dr. Klabr*

5. Hormonal modulation of renal metabolism and the pathophysiological consequences of acute ureteral obstruction and chronically reduced renal mass. *Dr. Klabr*

6. Ionic channels underlying stimulus-response coupling of cells; metabolically-regulated channels in pancreatic islet cells; ion channels underlying volume regulation in neuroblastoma and plant cells; stretch-activated and hormone modulated channels in bone cells. *Dr. Misler*

7. Studies on the biochemical control of parathyroid hormone biosynthesis, intracellular processing and secretion. *Dr. Morrissey*

8. Structural-functional correlations in renal disease. Studies on the pathophysiology of acute and chronic renal failure. *Dr. Purkerson*

9. Immunopathology of renal diseases: Role of macrophage in renal disease. *Dr. Schreiner*

10. Radioimmunoassay for parathyroid hormone. Role of the liver in the metabolism of parathyroid hormone. Studies investigate interrelationships between vitamin D metabolites and parathyroid metabolism. *Dr. Slatopolsky*

Section of Applied Physiology

(A) Clinical Elective. Exercise in Medicine and Preventive Medicine. Six weeks, all day. Students will participate as members of Applied Physiology Section's clinical team, doing exercise-testing, with measurement of oxygen uptake and cardiac output, and metabolic studies; and working with patients with coronary artery disease, diabetes, and/or hypertension who are undergoing exercise-training as part of their treatment. *Drs. Ehsani, Holloszy, W. Martin, Staten*

(B) Research Elective. Physiology and Biochemistry of Exercise. Research deals with the acute and chronic responses to exercise. Areas include biochemical adaptation in muscle in response to endurance exercise; cardiac adaptations to increased work load; the serum triglyceride lowering effect of exercise; the biochemical basis of muscle fatigue and the insulin-like effect of exercise. *Drs. Holloszy and Ehsani*

Faculty

**Adolphus Busch Professor
and Chairman of Department**

David M. Kipnis, M.D.,
University of Maryland, 1951.

**Dorothy R. and Hubert C.
Moog Professor and Interim
Associate Chairman of
Department**

Robert M. Senior, M.D., George
Washington University, 1961.

Professors Emeriti

**Irene E. and Michael M. Karl
Professor of Endocrinology
and Metabolism**

William H. Daughaday, M.D.,
Harvard University, 1943.

Carl G. Harford, M.D.,
Washington University, 1933.

Virginia Minnich, M.S., Iowa
State College, 1938.

Edward H. Reinhard, M.D.,
Washington University, 1939.
(See Department of Radiology.)

Robert E. Shank, M.D.,
Washington University, 1939.

Professors

David H. Alpers, M.D., Harvard
University, 1960.

John P. Atkinson (Howard
Hughes Medical Institute
Investigator in Medicine), M.D.,
University of Kansas, 1969.
(See Department of Molecular
Microbiology.)

**Sydney M. and Stella H.
Shoenberg Professor**

Louis V. Avioli, M.D., Yale
University, 1957.

Clifton A. Baile (Adjunct
Professor of Nutrition in
Medicine), Ph.D.,
University of Missouri, 1965.

John P. Boineau, M.D., Duke
University, 1959. (See Department
of Surgery.)

Elmer B. Brown, Jr., M.D.,
Washington University, 1950.
(See Administration.)

Hugh Chaplin, Jr., M.D.,
Columbia University, 1947.
(See Department of Pathology.)

Lewis R. Chase, M.D., Harvard
University, 1964. (Chief,
Washington University Medical
Services, Cochran V.A. Hospital)

Peter B. Corr (Pharmacology),
Ph.D., Georgetown University,
1975. (See Department of
Pharmacology.)

Philip E. Cryer, M.D.,
Northwestern University, 1965.
(Also Clinical Research Center)

William H. Danforth, M.D.,
Harvard University, 1951. (See
Administration.)

**Lewis T. and Rosalind B. Apple
Professor of Oncology in
Medicine**

Thomas F. Deuel, M.D.,
Columbia University, 1961. (See
Department of Biochemistry and
Molecular Biophysics.)

**The Winfred A. and Emma R.
Showman Professor of
Dermatology**

Arthur Z. Eisen (Dermatology),
M.D., University of Pennsylvania,
1957.

Jeffrey I. Gordon, M.D.,
University of Chicago, 1973. (See
Department of Biochemistry and
Molecular Biophysics.)

Marc R. Hammerman, M.D.,
Washington University, 1972.

Geoffrey P. Herzig, M.D.,
Western Reserve University, 1967.

John O. Holloszy, M.D.,
Washington University, 1957.

Keith A. Hruska, M.D., Creighton
University, 1969.

John J. Jeffrey, Jr.
(Dermatology), Ph.D.,
Georgetown University, 1965. (See
Department of Biochemistry and
Molecular Biophysics.)

M. Kenton King, M.D.,
Vanderbilt University, 1951. (See
Administration.)

**Joseph Friedman Professor of
Renal Diseases in Medicine**

Saulo Klahr, M.D., Universidad
Nacional de Colombia, 1959.

Robert E. Kleiger, M.D., Harvard
University, 1960.

George S. Kobayashi
(Microbiology), Ph.D., Tulane
University, 1963. (See Department
of Molecular Microbiology.)

Rosalind H. Kornfeld, Ph.D.,
Washington University, 1961.
(See Department of Biochemistry
and Molecular Biophysics.)

Stuart A. Kornfeld, M.D.,
Washington University, 1962.
(See Department of Biochemistry
and Molecular Biophysics.)

Jack H. Ladenson
(Clinical Chemistry), Ph.D.,
University of Maryland, 1971.
(See Department of Pathology.)

Stephen S. Lefrak, M.D., State
University of New York,
Downstate, 1965.

J. Russell Little, Jr., M.D.,
University of Rochester, 1956.
(See Department of Molecular
Microbiology.)

Philip A. Ludbrook, M.B., B.S.,
University of Adelaide, 1963. (See
Department of Radiology.)

Richard P. MacDermott, M.D.,
Ohio State University, 1969.

Jay M. McDonald, M.D., Wayne
State University, 1969. (See Depart-
ment of Pathology.) (Director of
Diagnostic Laboratories, Barnes
Hospital)

John A. McDonald, Ph.D., Rice
University, 1970; M.D., Duke
University, 1973. (See Department
of Biochemistry and Molecular
Biophysics.)

Philip W. Majerus, M.D.,
Washington University, 1961.
(See Department of Biochemistry
and Molecular Biophysics.)

Robert P. Mecham, Ph.D.,
Boston University, 1976. (See
Department of Cell Biology and
Physiology.)

Gerald Medoff, M.D.,
Washington University, 1962.
(See Department of Molecular
Microbiology.)

Aubrey R. Morrison, M.B., B.S., University of London, 1970. (See Department of Pharmacology.)

Charles W. Parker, M.D., Washington University, 1953. (See Department of Molecular Microbiology.)

William A. Peck, M.D., University of Rochester, 1960. (See Administration.)

M. Alan Permutt, M.D., Washington University, 1965.

H. Mitchell Perry, Jr., M.D., Washington University, 1946.

Selma and Herman Seldin Professor of Medicine

John A. Pierce, M.D., University of Arkansas, 1948.

Mabel L. Purkerson, M.D., Medical College of South Carolina, 1956. (See Administration and Department of Pediatrics.)

David Schlessinger (Microbiology), Ph.D., Harvard University, 1960. (See Department of Molecular Microbiology.)

William B. Kountz Professor of Medicine

Gustav Schonfeld, M.D., Washington University, 1960.

Benjamin D. Schwartz (Howard Hughes Medical Institute Investigator in Medicine), Ph.D., Albert Einstein College of Medicine, 1971; M.D., 1972. (See Department of Molecular Microbiology.)

Barry A. Siegel, M.D., Washington University, 1969. (See Department of Radiology.)

Eduardo Slatopolsky, M.D., University of Buenos Aires, 1959.

The Tobias and Hortense Lewin Professor of Cardiovascular Diseases

Burton E. Sobel, M.D., Harvard University, 1962.

Kenneth S. K. Tung, M.B.B.S., University of Melbourne, Australia, 1959.

Research Professors

Irene E. Karl, Ph.D., University of Wisconsin, 1940.

James G. Miller, Ph.D., Washington University, 1969. (Also Faculty of Arts and Sciences)

Professors Emeriti (Clinical)

Ralph V. Gieselmann, M.D., Washington University, 1947.

Paul O. Hagemann, M.D., Washington University, 1934.

Clinton W. Lane (Dermatology), M.D., St. Louis University, 1921.

Morris D. Marcus (Dermatology), M.D., Washington University, 1934.

Edward Massie, M.D., Washington University, 1935.

Franz U. Steinberg, M.D., University of Berne, 1938. (See Department of Surgery.)

Professors (Clinical)

I. J. Flance, M.D., Washington University, 1935.

Bernard T. Garfinkel, M.D., Washington University, 1948.

Neville Grant, M.D., Columbia University, 1954.

Harold J. Joseph, M.D., University of Texas, 1950.

Michael M. Karl, M.D., University of Louisville, 1938.

Philip E. Korenblat, M.D., University of Arkansas, 1960.

Marvin E. Levin, M.D., Washington University, 1951.

Virgil Loeb, Jr., M.D., Washington University, 1944.

William V. Miller (Visiting Staff), M.D., University of Missouri, 1966. (See Department of Pathology.)

G. Charles Oliver, M.D., Harvard University, 1957.

Robert C. Packman, M.D., Washington University, 1956.

Robert Paine, M.D., Harvard University, 1944.

Burton A. Shatz, M.D., Washington University, 1943.

Laurence A. Sherman, M.D., Albany Medical College, 1964. (See Department of Pathology.)

Associate Professors

Julian L. Ambrus, M.D., Jefferson Medical College, 1979.

Steven R. Bergmann (Medical Physiology), Ph.D., Hahnemann Medical College, 1977; M.D., Washington University, 1985.

Dennis M. Bier, M.D., New Jersey College of Medicine, 1966. (See Department of Pediatrics.)

Stanley J. Birge, Jr., M.D., Washington University, 1963.

Eric J. Brown, M.D., Harvard University, 1975. (See Department of Molecular Microbiology.)

George J. Broze, Jr., M.D., Washington University, 1972.

Michael E. Cain, M.D., George Washington University, 1975.

Ray E. Clouse, M.D., Indiana University, 1976.

James A. Delmez, M.D., University of Rochester, 1973.

David N. Dietzler (Clinical Chemistry), Ph.D., Washington University, 1963. (See Department of Pathology.)

Ali A. Ehsani, M.D., Tehran University, 1965. (See Irene Walter Johnson Institute of Rehabilitation.)

Lawrence D. Gelb, M.D., Harvard University, 1967. (See Department of Molecular Microbiology.)

Edward M. Geltman, M.D., New York University, 1971. (See Department of Radiology.)

Gregory A. Grant (Dermatology), Ph.D., University of Wisconsin, 1975. (See Department of Biochemistry and Molecular Biophysics.)

Richard W. Gross, M.D., New York University, 1976; Ph.D., Washington University, 1982. (See Department of Pharmacology.) (Also Department of Chemistry)

Samuel B. Guze, M.D., Washington University, 1945. (See Department of Psychiatry.)

L. Lee Hamm III (Established Investigator of the American Heart Association), M.D., University of Alabama, 1976.

Scot G. Hickman (Clinical Academic), M.D., Washington University, 1970.

Allan S. Jaffe, M.D., University of Maryland, 1973.

Stanley J. Korsmeyer (Howard Hughes Medical Institute Investigator in Medicine), M.D., University of Illinois, 1976. (See Department of Molecular Microbiology.)

Donald J. Krogstad, M.D., Harvard University, 1969. (See Department of Pathology.) (Director of Microbiology Laboratory, Barnes Hospital)

Ronald Krone (John E. Simon Scholar in Medicine), M.D., University of Chicago, 1966.

Anthony Kulczycki, Jr., M.D., Harvard University, 1970. (See Department of Molecular Microbiology.)

Thomas S. Kupper (Dermatology), M.D., Yale University, 1981.

Louis G. Lange, III, M.D., Harvard University, 1976; Ph.D., 1976. (See Department of Pathology.)

Dennis Y. Loh (Howard Hughes Medical Institute Associate Investigator in Medicine), M.D., Harvard Medical School, 1977. (See Departments of Genetics and Molecular Microbiology.)

Kenneth M. Ludmerer, M.D., Johns Hopkins University, 1973.

Allan P. Lyss, M.D., Washington University, 1976.

Bruno Maresca (Visiting), Ph.D., University of Naples, Naples, Italy, 1974.

Joseph P. Miletich, M.D., Ph.D., Washington University, 1979. (See Department of Pathology.)

Thalachallour Mohanakumar, Ph.D., Duke University, 1974. (See Departments of Pathology and Surgery.)

Patrick R. Murray (Clinical Microbiology), Ph.D., University of California, 1974. (See Department of Pathology.)

Richard E. Ostlund, Jr., M.D., University of Utah, 1970.

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Robert P. Perrillo, M.D., Georgetown University, 1970.

Moon H. Nahm, M.D., Washington University, 1974. (See Department of Pathology.)

John C. Rogers, M.D., University of Nebraska, 1968. (Also Department of Biology)

Peter S. Rotwein, M.D., Albert Einstein College of Medicine, 1975. (See Department of Genetics.)

Rodolphe Ruffy, M.D., University of Lausanne, 1968.

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Jeffrey E. Saffitz, Ph.D., Case Western Reserve University, 1977; M.D., 1978. (See Department of Pathology.)

Julio V. Santiago, M.D., University of Puerto Rico, 1967. (See Department of Pediatrics.)

Samuel A. Santoro, M.D., Vanderbilt University, 1979; Ph.D., 1979. (See Department of Pathology.)

George F. Schreiner (Established Investigator of the American Heart Association), M.D., Ph.D., Harvard University, 1977. (See Department of Pathology.)

Daniel P. Schuster, M.D., Yale University, 1976.

Louis Simchowicz, M.D., New York University, 1970. (See Department of Cell Biology and Physiology.)

Isaias Spilberg, M.D., University of San Marcos, 1963.

William F. Stenson, M.D., Washington University, 1971.

Alan J. Tiefenbrunn, M.D., Washington University, 1974. (See Department of Radiology.)

Douglas M. Tollefsen, M.D., Washington University, 1977; Ph.D., 1977. (See Department of Biochemistry and Molecular Biophysics.)

John W. Turk, M.D., Ph.D., Washington University, 1976. (See Department of Pathology.)

Peter G. Tuteur, M.D., University of Illinois, 1966.

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Howard G. Welgus (Dermatology), M.D., Washington University, 1977.

Michael P. Whyte, M.D., State University of New York, 1972. (See Department of Pediatrics.)

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Research Associate Professors

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Associate Professors Emeriti (Clinical)

James W. Bagby (Dermatology), M.D., Washington University, 1933.

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Joseph C. Edwards, M.D., Harvard University, 1934.

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Associate Professors (Clinical)

Jack Barrow, M.D., Washington University, 1946.

Benjamin A. Borowsky, M.D., Washington University, 1958.

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Melvin L. Goldman, M.D., Washington University, 1943.

Siddhesh Gowda, M.B., B.S., Medical College Bellary Mysore, 1969.

James N. Heins, M.D., University of Louisville, 1961.

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Robert S. Karsh, M.D., Washington University, 1952.

John J. Kelly, M.D., St. Louis University, 1963.

Charles Kilo, M.D., Washington University, 1959.

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Joseph Levitt, M.D., Washington University, 1949.

David M. Lieberman, M.D., Vanderbilt University, 1949.

Harvey Liebhaber, M.D., New York University, 1957.

Herbert Lubowitz, M.D., Washington University, 1958.

William E. Magee, M.D., Duke University, 1950.

Robert S. Mendelsohn, M.D., Washington University, 1954.

Edward J. Miller, M.D., St. Louis University, 1962.

James F. Nickel, M.D., Washington University, 1948.

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Mary L. Parker, M.D., Washington University, 1953. (University Health Service)

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Ernest T. Rouse, M.D., Washington University, 1943.

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Llewellyn Sale, Jr., M.D., Washington University, 1940.

James C. Sisk (Dermatology), M.D., Washington University, 1946.

Ross B. Sommer, M.D., Cornell University, 1949.

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Stanley M. Wald, M.D., Washington University, 1946.

Alan N. Weiss, M.D., Ohio State University, 1966.

Alvin S. Wenneker, M.D., Washington University, 1953.

Assistant Professors

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Stuart R. Adler, M.D., Ph.D., Duke University, 1982.

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Joseph J. Billadello, M.D., Georgetown University, 1978.

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Stephen J. Giddings, Ph.D., Dartmouth College, 1973; M.D., University of Rochester, 1976.

Stephen L. Gluck, M.D., University of California, 1977. (See Department of Cell Biology and Physiology.)

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James A. Goldstein, M.D., University of Chicago School of Medicine, 1976.

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Michael J. Holtzman, M.D., Northwestern University, 1975.

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Leslie E. Kahl, M.D., Albany Medical College, 1978.

Michael G. Kahn, M.D., University of California, San Diego, 1979; Ph.D., University of California, San Francisco, 1988.

Joseph L. Kenzora, M.D., University of New Mexico Medical School, 1975.

Paula M. Kinnunen, M.D., Harvard Medical School, 1981.

Robert G. Kopitsky, M.D., Duke University, 1982.

Sandor J. Kovacs, Ph.D., California Institute of Technology, 1977; M.D., University of Miami, 1979.

James B. Lefkowitz, M.D., Johns Hopkins School of Medicine, 1979.

Marc S. Levin, M.D., Columbia College of Physicians and Surgeons, 1981.

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Bruce D. Lindsay, M.D., Jefferson Medical College, 1977.

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Robert C. McKnight, M.D., Washington University, 1961. (See Department of Radiology.)

Wade H. Martin III, M.D., University of Kansas, 1977.

Jeffrey D. Milbrandt, M.D., Washington University School of Medicine, 1978; Ph.D., University of Virginia, 1983. (See Department of Pathology.)

Stanley Misler, M.D., Ph.D., New York University, 1977. (See Department of Cell Biology and Physiology.)

Paul David Olivo, M.D., University of Florida, 1981; Ph.D., 1982.

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Alice Pentland, (Dermatology), M.D., University of Michigan, 1978. (See Department of Pharmacology.)

Marion Peters, M.B.B.S., Melbourne University, 1972. (See Department of Molecular Microbiology.)

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William G. Powderly, M.B., B.Ch., B.A.O., National University of Ireland, 1979.

Lee Ratner, M.D., Ph.D., Yale University, 1979. (See Department of Molecular Microbiology.)

Michael W. Rich, M.D., University of Illinois, Chicago, 1979.

Marcos Rothstein, M.D., University of Zulia, 1974.

Deborah C. Rubin, M.D., Albert Einstein College of Medicine, 1981.

Eric R. Simon, M.D., University of Chicago, Pritzker School of Medicine, 1976.

Samuel L. Stanley, M.D., Harvard University, 1980.

Myrlene A. Staten, M.D., University of Texas, 1979.

Thomas H. Steinberg, M.D., New York University, 1978. (See Department of Cell Biology and Physiology.)

Gregory A. Storch, M.D., New York University, 1973. (See Department of Pediatrics.)

J. Regan Thomas (Dermatology), M.D., University of Missouri School of Medicine, 1972. (See Department of Otolaryngology.)

Elbert P. Trulock III, M.D., Emory University, 1978.

Gary J. Weil, M.D., Harvard University, 1975.

Samuel A. Wickline, M.D., John A. Burns School of Medicine, 1980.

David W. Windus, M.D., Creighton University, 1978.

Robert A. Wolf, M.D., Harvard University, 1980.

Research Assistant Professor Emeritus

Ida K. Mariz, A.B., Washington University, 1940.

Research Assistant Professors

Dana R. Abendschein, Ph.D., Purgue University, 1978.

Thomas W. Allen (Education), Ed.D., Harvard University, 1966. (Also Graduate Institute of Education)

Alex J. Brown, Ph.D., University of Tennessee, 1982.

Thomas G. Cole, M.D., University of Missouri, 1974; Ph.D., 1980.

Alan Daugherty, Ph.D., University of Bath, 1982.

Douglas C. Dean, Ph.D., University of Kansas School of Medicine, 1981.

Mary Anne Della-Fera (Adjunct), V.M.D., University of Pennsylvania, 1979; Ph.D., 1980.

Ruth L. Fischbach (Sociology), Ph.D., Boston University, 1983. (See Department of Psychiatry.)

Edwin B. Fisher, Jr. (Psychology), Ph.D., State University of New York, 1972.

David A. Ford, Ph.D., University of Missouri, Columbia, 1984.

Elaine S. Krul, Ph.D., McGill University, 1982.

Carol L. McLaughlin (Adjunct), Ph.D., University of Pennsylvania, 1981.

Theodore W. Munns, Ph.D., St. Louis, University, 1970.

William C. Parks, Ph.D., Medical College of Wisconsin, 1982.

Curtis A. Parvin (Clinical, Computer Science), Ph.D., University of Minnesota, 1980. (See Department of Pathology and Division of Biostatistics.)

Kenneth B. Schechtman, Ph.D., Washington University, 1978. (See Division of Biostatistics and Institute for Biomedical Computing.)

Mitchell G. Scott (Clinical), Ph.D., Washington University School of Medicine, 1982. (See Department of Pathology.)

Jo L. Seltzer (Dermatology), Ph.D., Washington University, 1969.

Victor A. Silva (Clinical), M.D., St. Louis University School of Medicine, 1971. (See Department of Pathology.)

Curtis A. Spillburg, Ph.D., Northwestern University, 1972.

Andrew N. Tyler, Ph.D., University of Manchester Institute of Science and Technology, 1982. (See Department of Biochemistry and Molecular Biophysics.)

Kathryn A. Yamada, Ph.D., Georgetown University, 1982.

Assistant Professors Emeriti (Clinical)

William K. Hall (Dermatology), M.D., Washington University, 1942.

James H. Hutchinson, Jr., M.D., University of Arkansas, 1945.

Robert C. Kingsland, M.D., Washington University, 1937.

M. Norman Orgel, M.D., Washington University, 1934.

Harold K. Roberts, M.D., Ohio State University, 1939.

Assistant Professors (Clinical)

Charles C. Abel, M.D., Washington University, 1956.

Oliver Abel III, M.D., Washington University, 1955.

Gail A. Ahumada, M.D., University of California, San Diego, 1972.

Morris Alex, M.D., Washington University, 1943.

Om P. Bahl, M.R.C.P., University of Edinburgh, 1960.

Robert W. Barton, M.D., Ph.D., University of Chicago, 1967.

F. Douglas Biggs, M.D., Washington University, 1972.

Clifford A. Birge, M.D., Washington University, 1961.

Benje Boonshaft, M.D., Washington University, 1961.

William G. Bowen, M.D., University of North Carolina, 1974.

Leslie M. Brandwin, M.D., St. Louis University, 1971.

Robert M. Bruce, M.D., University of Minnesota, 1968.

Francis J. Catanzaro, M.D., Washington University, 1948.

Philip Comens, M.D., Washington University, 1951.

Ralph Copp, Jr., M.D., Washington University, 1952.

Duane E. Cozart, M.D., Medical College of Virginia, 1959.

Stephen R. Crespin, M.D., Harvard College, 1965.

John S. Daniels, M.D., University of Arkansas, 1974.

John D. Davidson, M.D., Washington University, 1952.

Vincent R. deMello, M.B., B.S., Seth G.S. Medical College, 1964.

Russell E. Eggebrecht, M.D., Washington University, 1971.

Seth A. Eisen, M.D., Washington University, 1966.

William A. Emerson, M.D., University of Washington, 1966.

James Etzkorn, M.D., St. Louis University, 1973.

Lewis C. Fischbein, M.D., Washington University, 1974.

Arnold M. Goldman, M.D., Washington University, 1959.

Benjamin M. Goldstein, M.D., Washington University, 1964.

David A. Goran, M.D., Washington University, 1976.

John M. Grant, M.D., Washington University, 1954.

Guner B. Gulmen, M.D., Hacettepe University, 1969.

David T. Hammond, M.D., Washington University, 1960.

Bernard Hulbert, M.D., University of Wisconsin, 1941.

Sidney Jick, M.D., Washington University, 1949.

Morris Joftus, M.D., University of Illinois, 1967.

Robert L. Kaufman, M.D., Washington University, 1963.

Donald K. King, M.D., Johns Hopkins, 1970. (See Health Key Medical Group.)

John H. Kissel, M.D., Harvard University, 1971.

Robert E. Kraetsch, M.D., Washington University, 1969.

Ralph F. Kuhlman, M.D., University of Illinois, 1964. (Also Student Health Service)

Jerrold J. Lander, M.D., Washington University, 1968.

Steven A. Lauter, M.D., Wayne State University, 1971.

Morton A. Levy, M.D., Washington University, 1961.

Douglas R. Lilly, M.D., Washington University, 1956.

Michael P. Lippman, M.D., SUNY, 1977.

Warren M. Lonergan, M.D., Vanderbilt University, 1940.

Carl A. Lyss, M.D., Washington University, 1956.

Jay P. Marshall II, M.D., University of Missouri, 1972.

Thomas F. Martin, M.D., St. Louis University, 1965.

Paul A. Mennes, M.D., Washington University, 1970.

J. Roger Nelson, M.D., Washington University, 1953.

Leonard N. Newmark, M.D., Washington University, 1963.

Gordon Newton, M.D., University of Arkansas, 1958.

Scott M. Nordlicht, M.D., State University of New York, Downstate, 1973.

David W. Ortals, M.D., Washington University, 1970.

James W. Owen, Jr., M.D., Washington University, 1946.

James C. Peden, Jr., M.D., Washington University, 1955.

MaryBeth Pereira, M.D., University of California, 1978.

William J. Phillips, M.D., Washington University, 1963.

Daniel E. Potts, M.D., Washington University, 1972.

Vincent J. Proskey, M.D., Marquette University, 1964.

Leon R. Robison, M.D., Case Western Reserve University, 1968.

Joseph F. Ruwitch, Jr., M.D., Washington University, 1966.

Scott R. Sale, M.D., St. Louis University, 1976.

Ali Salimi, M.D., University of Tehran, 1965.

Samuel E. Schechter, M.D., Washington University, 1941.

Robert J. Schneider, M.D., Johns Hopkins University, 1976.

William F. Southworth, M.D., Washington University, 1975.

Alan R. Spivack, M.D., St. Louis University, 1964.

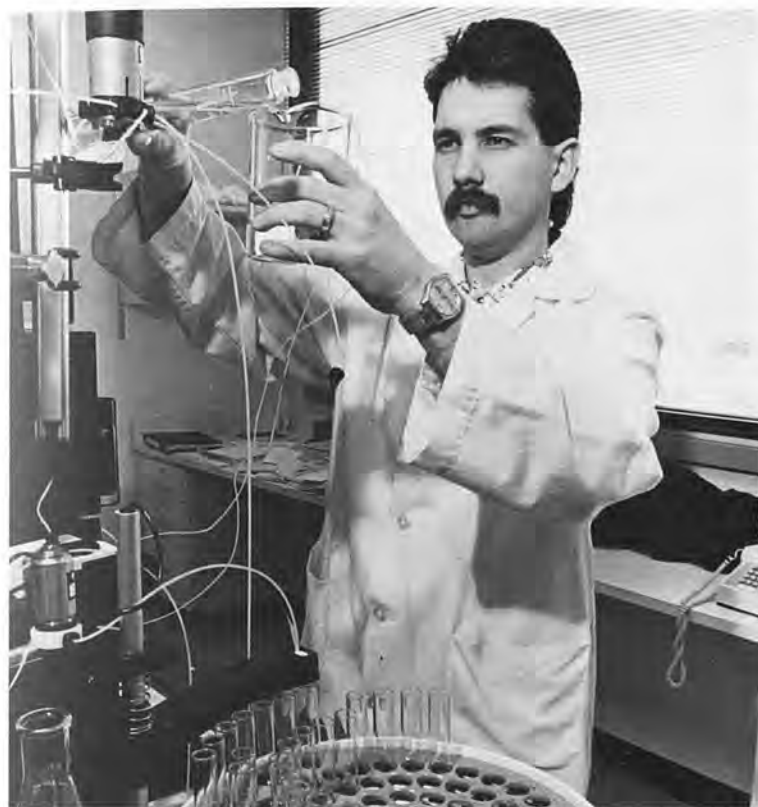
Linda G. Stanton, M.D., Boston University, 1979.

Paul M. Stein, M.D., St. Louis University, 1971.

Kongsak Tanphaichitr, M.D., Siraraj Hospital Medical School, 1970.

Robert M. Taxman, M.D., Washington University, 1964.

Elliot A. Wallach (Dermatology), M.D., St. Louis University, 1945.



James W. Walsh, M.D.,
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Gerald A. Wolff, M.D.,
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John A. Wood, M.D., Oklahoma
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Herbert B. Zimmerman, M.D.,
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Instructors

Giuseppi Aliperti, M.D.,
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Frank S. Calandrino, Jr., M.D.,
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Greta Camel, M.D., University of
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Vicki A. Canfield, M.D.,
University of Washington, 1980.

Patricia L. Cole, M.D., Harvard
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David H. Cort, M.D., University of
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Paula B. Davis, M.D., Case
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Kathryn M. Diemer, M.D.,
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William C. Dunagan, M.D.,
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Steven Edmundowicz, M.D.,
Jefferson Medical College, 1983.

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Departments of Anesthesiology
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Frederick T. Fiedorek, Jr., M.D.,
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Juan Garcia, M.D., University of
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Robert J. Glinert, M.D., Rush
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James R. Hansbrough, Ph.D.,
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James D. Kaplan, M.D.,
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Laurel Krewson (Clinical), B.S.,
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Research Instructors

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Steven M. Frisch (Dermatology),
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Debra L. Haire-Joshu, M.D.,
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Lisa P. Hyman, Ph.D., Medical
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Norma J. Janes, M.S., State
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Marylen L. Mann, M.A.,
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Geoffrey S. Nash, B.Sc., McGill
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Neil F. Rebbe, Ph.D., Washington
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Terrence E. Riehl, Ph.D., Ohio
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Leonard Rifas, M.S., University of
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Instructors Emeriti (Clinical)

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Instructors (Clinical)

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Frederick D. Bauschard
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Daniel B. Bauwens, M.D.,
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Gail L. Clark, M.D., St. Louis
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Frank Cohen, M.D., University of
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Charles Crecelius, Ph.D., St.
Louis University, 1984; M.D., 1984.

Karl J. Crossen, M.D., University
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Robert B. Cusworth, M.D.,
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Thomas A. Dew, M.D., University
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Carol F. Evers, M.D., Brown
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David Feldman, M.D.,
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Linda A. Fisher, M.D., Harvard
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Norman Fishman, M.D.,
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- B. Todd Forsyth, M.D.**, Washington University, 1947.
- William M. Gee, M.D.**, Washington University School of Medicine, 1981.
- Kenneth W. Gentsch, M.D.**, Washington University, 1958.
- Charlene C. Gottlieb, M.D.**, Washington University, 1972.
- Ronald K. Grady, M.D.**, Washington University, 1966.
- Jitendra K. Gupta, M.B., B.S.**, King George Medical College, 1964.
- Thomas E. Hakes, M.D.**, University of Iowa College of Medicine, 1978.
- Anne Herron, M.B., B.Ch.**, Dublin University, 1965.
- William E. Hinkley, M.D.**, Harvard University, 1969.
- Paul F. Hintze, M.D.**, University of Utah, 1978.
- Sandra S. Hoffman, M.D.**, University of Kansas, Kansas City, 1976.
- Bruce J. Hookerman** (Dermatology), M.D., St. Louis University, 1968.
- John L. Horner, M.D.**, Washington University, 1936.
- John W. Hubert, M.D.**, Washington University, 1975.
- Richard F. Huck, M.D.**, Washington University, 1948.
- Myron H. Jacobs, M.D.**, Louisiana State University, 1969.
- Micki Klearman, M.D.**, Washington University School of Medicine, 1981.
- Roop Lal, M.D.**, Osmania Medical College, India, 1975.
- Daniel K. Lane** (Dermatology), M.D., Washington University, 1959.
- Cathy J. Lazarus, M.D.**, Washington University, 1981.
- Ellis S. Lipsitz, M.D.**, St. Louis University, 1943.
- Howard S. Lite, M.D.**, University of Missouri, Columbia, 1983.
- Dan William Luedke, M.D.**, Baylor College of Medicine, 1971.
- Robert H. Lund, Jr.** (Dermatology), M.D., Washington University School of Medicine, 1979.
- Michael E. McCadden** (Dermatology), M.D., Vanderbilt University, 1982.
- David M. Margolis, M.D.**, University of Manitoba, 1971.
- David B. Marrs** (Dermatology), M.D., University of Texas Southwestern Medical School, 1978.
- Jerald Maslanko, M.D.**, Emory University, 1975. (See Health Key Medical Group.)
- Henry E. Mattis, M.D.**, Washington University, 1975.
- Charles W. Miller** (Dermatology), M.D., Washington University, 1972.
- Austin F. Montgomery, M.D.**, University of Pittsburgh, 1954.
- Arlen E. Morrison, M.D.**, Washington University, 1958.
- Frede Mortensen, M.D.**, New York Medical College, 1953.
- S. Michael Orgel, M.D.**, St. Louis University, 1965.
- Matthew J. Orland, M.D.**, University of Miami, 1979.
- Robert F. Owen, M.D.**, Yale University, 1952.
- Deborah L. Parks, M.D.**, University of Louisville, 1982.
- Lee S. Portnoff** (Dermatology), M.D., Washington University School of Medicine, 1978.
- John A. Powell** (Dermatology), M.D., University of Michigan, 1971.
- Gary Quick, M.D.**, University of Pittsburgh, 1972.
- William R. Reilly, M.D.**, University of Illinois, 1980.
- Lisa B. Ring** (Dermatology), M.D., Washington University, 1980.
- Ernest T. Rouse III, M.D.**, Washington University, 1971.
- Mehrdad Saeed-Vafa, M.D.**, Ferdowsi University, 1973.
- Robert J. Saltman, M.D.**, Washington University, 1980.
- Lawrence E. Samuels** (Dermatology), M.D., Washington University, 1976.
- Guadalupe Sanchez** (Dermatology), Ph.D., Duke University, 1980; M.D., 1980.
- Robert J. Scheff, M.D.**, Washington University, 1974.
- Susan B. Schneider, M.D.**, Yale University, 1977.
- John S. Schoentag** (Dermatology), M.D., Washington University, 1960.
- Kenneth E. Shafer, M.D.**, St. Louis University, 1979.
- Anil S. Shah, M.D.**, Smt. N.H.L. Medical College, Agnedabad, India, 1978.
- Bharat J. Shah, M.B., B.S.**, Guharat University, 1973.
- John B. Shapleigh II, M.D.**, Washington University, 1946.
- Gerald S. Shatz, M.D.**, Washington University, 1974.
- Bernard L. Shore, M.D.**, Washington University, 1977.
- Robert B. Shuman, M.D.**, University of Missouri, 1981.
- John S. Skinner, M.D.**, Washington University, 1940.
- Donald A. Skor, M.D.**, Rush Medical College, 1978.
- Allen D. Soffer, M.D.**, University of Missouri, Kansas City, 1983.
- Rand Sommer, M.D.**, Washington University, 1980.
- Elizabeth A. Stoddard, M.D.**, Washington University, 1957.
- William K. Sullivan, M.D.**, University of Missouri, 1974.
- In-Sook Sunwoo, M.D.**, Woo Sok University, 1959.
- Arnold S. Tepper, M.D.**, University of Missouri, 1970.
- Wanda T. Terrell, M.D.**, Washington University, 1979. (See Health Key Medical Group.)
- William M. Thomson, M.D.**, Johns Hopkins University, 1973.
- Sharon F. Tiefenbrunn** (Dermatology), M.D., Washington University, 1975.
- David J. Tucker, M.D.**, St. Louis University, 1981.
- Dolores R. Tucker** (Dermatology), M.D., Washington University, 1974.
- John H. Uhlemann** (Dermatology), M.D., Washington University, 1971.
- Albert L. Van Amburg III, M.D.**, Washington University, 1972.

Oksana Volshteyn, M.D., Minsk State Medical Institute, Minsk, U.S.S.R., 1976.

Stanley G. Vriezelaar, M.D., University of Iowa, 1981.

Richard C. Walters (Dermatology), M.D., Washington University, 1973.

Hugh R. Waters, M.D., Washington University, 1945.

Leonard B. Weinstock, M.D., University of Rochester, 1981.

Peter Weiss, M.D., Case Western Reserve University, 1980.

Daniel W. Whitehead, Jr., M.D., Washington University, 1980.

James R. Wiant, M.D., Jefferson Medical College, 1959.

Herbert C. Wiegand, M.D., Washington University, 1943.

R. Jerome Williams, Jr., M.D., Duke University, 1977.

Karen Winters, M.D., Southern Illinois University, Carbondale, 1983.

Edward M. Wolfe (Dermatology), M.D., Washington University, 1960.

James A. Wood, M.D., Washington University, 1949.

Megan Wren, M.D., Washington University, 1985.

Robert E. Ziegler (Dermatology), Ph.D., Duke University, 1980; M.D., 1986.

Research Associates

Marilyn J. Ackerman, Ph.D., Colorado State University, 1978.

Nalini S. Bora, Ph.D., All India Institute of Medical Sciences, 1981.

Thomas J. Broekelman, B.Sc., M.S., University of Missouri, St. Louis, 1981.

Steve B. Cousins, M.S., Washington University, 1987.

Donna M. Crecelius, Ph.D., St. Louis University, 1983.

William A. Dittman, M.D., Washington University, 1981.

Svetlana G. Elberg, M.S., University of Kharkov, 1959.

Larry E. Fields, M.D., Harvard College, 1980.

Marilyn M. Gordon, B.A., Lindenwood College, 1956.

Walter T. Gregory, B.S., St. Louis University, 1960.

Pilar Herrero, M.S., Vanderbilt University, 1984.

Michiko S. Huynh, Ph.D., Osaka University, Japan, 1985.

Ulrich Jaeger, M.D., University of Vienna, 1982.

Milan D. Kapadia, M.D., Indore University, 1974.

Catherine M. Ketcham, Ph.D., University of Florida, 1988.

Patricia M. McKeivitt, M.S.W., Washington University, 1969.

Audrey A. Painter, M.D., Northwestern University, 1957.

Neville S. Rapp, Ph.D., University of Missouri, Columbia, 1977.

Elizabeth A. Rayhel, Ph.D., Indiana State University, 1988.

William T. Roswit (Dermatology), B.A., Washington University, 1973.

David L. Steffens, Ph.D., Oklahoma State University, 1984.

Jeffrey P. Tillinghast, M.D., Washington University, 1980.

Glenda C. Webb, Ph.D., Johns Hopkins University, 1980.

Carol A. Weerts, M.A., Webster College, 1980.

Margherita G. Wuebker, M.D., University of Padua, Italy, 1963.

Jesse T. Yates, B.S., Fisk University, 1956.

De-Quan Ye, M.D., Shanghai Second Medical College, 1982; Ph.D., Washington University School of Medicine, 1988.

Research Assistants

Sharon E. Carmody, B.A., Webster College, 1960.

Howard L. Christopherson, M.S., University of Minnesota, 1953.

Margaret W. Erlanger, M.S., University of Iowa, 1938.

Jane Lewis Finch, B.S., Central Missouri State University, 1971.

Silvia L. Hilker, M.D., University of Mexico, 1979.

Thomas Howard, Sr.

Charles L. McConkey, Jr., M.S., Southern Illinois University, 1975.

Dale F. Osborne, B.S., Louisiana State University, 1971.

Claire K. Pedersen, B.S., Quincy College, 1948.

Betty F. Perry, A.B., Washington University, 1945.

Mary L. Smidt, Ph.D., University of California, Davis, 1978.

Assistants (Clinical)

William D. Birenbaum, M.D., University of Missouri, 1983.

David Blumenthal, M.D., Washington University, 1983.

Susan G. Brown, M.D., St. Louis University School of Medicine, 1984.

Ethan M. Cruvant, M.D., Washington University School of Medicine, 1984.

James D. Cury, M.D., University of Miami School of Medicine, 1981.

Irl J. Don, M.D., Washington University, 1972. (See Health Key Medical Group.)

Michael J. Fedak, M.D., University of Missouri, Columbia, 1982.

Kathleen M. Garcia, M.D., Harvard University, 1980. (See Health Key Medical Group.)

Nancy Z. Guggenheim, M.D., Brown University, 1980.

Faith H. Holcombe, M.D., Washington University, 1980. (See Health Key Medical Group.)

Raymond J. Hu, M.D., University of Missouri School of Medicine, 1982.

Robert Loeffer, M.D., Washington University, 1984.

Susan M. Manns-Risso, M.D., St. Louis University School of Medicine, 1984.

John E. Mullins, M.D., Washington University, 1958.

Peter R. Pless (Dermatology), M.D., SUNY, New York, 1981.

John H. Rice, M.D., University of Missouri, 1980.

Tania L. Schmid, M.D., University of Mississippi, 1985.

***DEPARTMENT OF
MOLECULAR
MICROBIOLOGY***



MOLECULAR MICROBIOLOGY

The Department of Molecular Microbiology teaches introductory courses in microbiology and pathogenic microorganisms for first-year medical students and graduate students. The course in molecular microbiology is taught in collaboration with the Division of Infectious Diseases of the Department of Medicine. The Department also offers a number of advanced courses, primarily designed for graduate students, but open to medical students. Advanced elective research activities are offered by faculty in the Department.

FIRST YEAR

Molecular Microbiology

The molecular microbiology course is given in the second semester of the first year and combines topics in basic microbiology, molecular biology and pathogenic microorganisms. The first half of the course focuses on the molecular biology of bacteria, fungi and protozoa and includes mechanisms of antibiotics, mechanisms of gene transfer and recombination, and regulation of gene expression with emphasis on genes expressing proteins affecting pathogenesis. A set of laboratory exercises introduces the student to selective metabolic and physiological properties of different bacteria. The second half of the course includes topics in molecular virology but deals primarily with selected groups of human pathogens and their interactions with the host.

RESEARCH

Bio 590.

These electives acquaint the student with the analyses that are used in present-day biomedical research, especially at the molecular level. *Staff*

Processing and decay of RNA in *E. coli* and mammalian cells, normal and malignant. Differentiation-activation of unexpressed genes in mammalian cells. *Dr. Apirion*

The complement system and immune complex processing: functional, genetic, biochemical and molecular analysis. *Dr. Atkinson*

Mechanisms and evolution of gene transposition and of antibiotic resistance in bacteria. *Dr. Berg*

Mechanisms and control of phagocytic function. Biochemistry and cellular physiology of IgG and complement receptors and the cellular pathways needed for their efficient function are studied in detail. *Dr. Brown*



Structure, organization, and regulation of MHC genes. Molecular and cellular biology of interleukin-1. *Dr. Chaplin*

Genetics and molecular biology of *Mycobacterium leprae*. *Dr. Clark-Curtiss*

Regulation of complement and acute phase protein gene expression, pulmonary immunology, inflammation. *Dr. Colten*

Immune response regulation by antigen presenting cells; function of Ia molecules. *Dr. Cullen*

Structure and biosynthesis of antibodies; immunoglobulin expression in hybridoma cells. *Dr. Fleischman*

Biochemistry and biology of varicella-zoster virus. *Dr. Gelb*

Enzymology of connective tissue remodeling. Structure of mouse minor satellite DNA. *Dr. Goldberg*

Molecular basis of pathogenicity of *Histoplasma capsulatum* and *Bordetella pertussis*. In vitro models of respiratory tract infections and toxin effects. Biochemical analysis and genetic manipulation of virulence-related phenotypes. *Dr. Goldman*

Immunity to haemophilus influenzae. *Dr. Granoff*

Molecular biology of alphaviruses. Alphavirus gene expression vectors. Structure-function of regulatory proteins. *Dr. Huang*

Immune regulation and autoimmunity. *Dr. Kapp-Pierce*

Biochemistry and genetics of macromolecule regulation: mRNA metabolism in bacteria; regulation of metabolism in cultured mammalian cells. *Dr. Kennell*

Exploring the molecular genetics of normal human lymphoid differentiation and the mechanisms of transformation for the corresponding lymphoid malignancies. *Dr. Korsmeyer*

Structures, functions, and molecular genetics of receptors for IgG and IgE. *Dr. Kulczycki*

Differentiation and function of mononuclear phagocytes. *Dr. Lin*

Macrophage effector functions and host defenses against fungal infections. Adjuvants and cytokines as immune modulators. *Dr. Little*

Molecular genetics of lymphocyte specific genes using transfection and transgenic mice. *Dr. Lob*

Development of therapy for intracellular bacterial and fungal infections. *Drs. Kobayashi, Medoff*

Regulation of the phase transition of the dimorphic fungal pathogen *Histoplasma capsulatum*. *Dr. Medoff*

Cellular immunology; immediate hypersensitivity. *Dr. Parker*

Human B cell activation and the role of soluble factors in B cell immunoregulation in both normal peripheral blood and intestinal lymphocytes and in patients with chronic GI and liver disease. *Dr. Peters*

Mechanisms regulating immune responses in tissue culture systems. *Dr. Pierce*

Studies of the immunological and pharmacological mechanisms by which autacoids (i.e., local hormones) regulate lymphocyte function. *Dr. Polmar*

Structure and function of human retroviruses including HTLV1, a cause of Leukemia, and HTLV3, the cause of AIDS. The major focus is in studying molecular clones of these viral genes important in replication and regulating abnormalities in cell growth. *Dr. Ratner*

Molecular genetics of animal RNA viruses (alpha-viruses and flaviviruses): replication, packaging, and virulence. *Dr. Rice*

Interactions between RNA animal viruses and their host cells. Emphasis on maturation and assembly of viral proteins. The heat-shock response; function of heat-shock proteins. *Dr. M. Schlesinger*

Structure and replication of enveloped RNA animal viruses. *Dr. S. Schlesinger*

Ribosome formation and nucleolar function; Basis of X-linked diseases. *Dr. D. Schlessinger*

Molecular immunology, immunobiology and immunopathology, biochemistry and molecular biology of macrophage activating lymphokines. *Dr. Schreiber*

Biochemistry, molecular biology, and molecular immunology of HLA class II molecules. Molecular mechanisms underlying HLA-disease associations. *Dr. Schwartz*

Antibody response to polysaccharide antigens in children. *Dr. Shackelford*

Study of the molecular biology of the T-200 family of leukocyte proteins. The purpose is to characterize this family of proteins which are specific only for leukocytes but which differ among them. *Dr. Thomas*

ELECTIVES

At present the primary enrollees in these courses are students working for a Ph.D. degree in one of the basic sciences. However, these courses are recommended for interested medical students, especially those who may be considering a career in medical research. Emphasis is placed on the organization and function of living systems at the molecular level. The courses combine formal lectures with student-directed seminars. In the latter, each student has an opportunity to integrate various disciplines of modern molecular biology into the area of biology or medicine that is of particular interest to him. Those courses most relevant to the field of microbiology are listed under the Division of Biology and Biomedical Sciences.

Bio 5051. Foundations in Immunology

An in-depth introduction to immunology designed for graduate students. Topics: antibody structure and genetics, B cell recognition, T cell receptor, major histocompatibility complex, T cell recognition, regulation of the immune response, immune mediators, humoral and cellular effector mechanisms, immune control of infectious disease, immunopathology including hypersensitivity and deficiency. Credit 3 units. *Dr. Cullen*

Bio 5221. Molecular Basis of Microbial Pathogenesis

Primarily for graduate and MSTP students, this seminar course involves discussion of current research on pathogenic microorganisms and their virulence determinants. Emphasis on new research strategies for studying the molecular mechanisms of pathogenesis and the factors controlling host-pathogen interactions. Prerequisite: One and one half class hours per week, 1 unit credit. *Dr. Goldman*

Bio 539. Topics in Animal Virology: The Molecular Biology of Animal and Plant Viral Diseases

RNA and DNA virus replication, shutoff of host protein biosynthesis, interferon, retroviruses with emphasis on chronic diseases (i.e., visna, AIDS), defective viruses (i.e., satellite RNA of tobacco ring spot virus, hepatitis delta virus), viruses as vectors and their possible role in preventing disease. Course consists of lectures and discussions of original papers. Credit 3 units. *Drs. M. Schlesinger, S. Schlesinger, C. Rice*

Note—The number preceding the course title indicates that the course carries credit in the Graduate School of Arts and Sciences.

Faculty

Professor and Acting Head of Department

Milton J. Schlesinger, Ph.D., University of Michigan, 1959.

Professors

David Apirion, Ph.D., University of Glasgow, 1963.

John P. Atkinson, M.D., Kansas University, 1969. (See Department of Medicine.)

Douglas E. Berg, Ph.D., University of Washington, 1969. (See Department of Genetics.)

Harvey R. Colten, M.D., Western Reserve University, 1963; M.A. (hon.), Harvard University, 1978. (See Department of Pediatrics.)

Susan E. Cullen, Ph.D., Albert Einstein College of Medicine, 1971. (See Department of Genetics.)

M. Wayne Flye, M.D., University of North Carolina, 1967; Ph.D., Duke University, 1980; M.A. (hon.), Yale University, 1985. (See Department of Surgery.)

Judith A. Kapp-Pierce, Ph.D., Harvard University, 1976. (See Department of Pathology) (Jewish Hospital)

David E. Kennell, Ph.D., University of California, 1959.

George S. Kobayashi, Ph.D., Tulane University, 1963. (See Department of Medicine.)

J. Russell Little, Jr., M.D., University of Rochester, 1956. (See Department of Medicine.) (Jewish Hospital)

Gerald Medoff, M.D., Washington University, 1962. (See Department of Medicine.)

Charles W. Parker, M.D., Washington University, 1953. (See Department of Medicine.)

Carl W. Pierce, Ph.D., University of Chicago, 1966; M.D., 1966. (See Department of Pathology.) (Jewish Hospital)

Stephen H. Polmar, Ph.D., Union College, 1966; M.D., Case Western Reserve University, 1967. (See Department of Pediatrics.)

Sondra Schlesinger, Ph.D., University of Michigan, 1960.

David Schlessinger, Ph.D., Harvard University, 1961. (See Departments of Genetics and Medicine.)

Robert D. Schreiber, Ph.D., State University of New York, 1973. (See Department of Pathology.)

Benjamin D. Schwartz, Ph.D., Albert Einstein College, 1971; M.D., 1972. (See Department of Medicine.)

Associate Professors

Eric J. Brown, M.D., Harvard University, 1975. (See Department of Medicine.)

Julian B. Fleischman, Ph.D., Harvard University, 1960.

Lawrence D. Gelb, M.D., Harvard University, 1967. (See Department of Medicine.)

Dan M. Granoff, M.D., Johns Hopkins University, 1968. (See Department of Pediatrics.)

Stanley J. Korsmeyer, M.D., University of Illinois, 1976. (See Department of Medicine.)

Anthony Kulczycki, Jr., M.D., Harvard University, 1970. (See Department of Medicine.)

Hsiu-san Lin, M.D., National Taiwan University, 1960; Ph.D., University of Chicago, 1968. (See Department of Radiology.)

Penelope G. Shackelford, M.D., Washington University, 1968. (See Department of Pediatrics.)

Assistant Professors

David D. Chaplin, Ph.D., Washington University, 1980; M.D., 1980. (See Department of Medicine.)

William E. Goldman, Ph.D., University of North Carolina, 1980.

Henry V. Huang, Ph.D., California Institute of Technology, 1977.

Dennis Loh, M.D., Harvard University, 1977. (See Departments of Genetics and Medicine.)

Richard B. Markham, M.D., Albert Einstein College of Medicine, 1972. (See Department of Medicine.)

Marion Peters, M.B.B.S., Melbourne University, 1972. (See Department of Medicine.)

Lee Ratner, M.D., Ph.D., Yale University, 1979. (See Department of Medicine.)

Charles M. Rice, Ph.D., California Institute of Technology, 1981.

Matthew L. Thomas, Ph.D., University of Utah, 1981. (See Department of Pathology.)

Research Assistant Professors

Josephine E. Clark-Curtiss, Ph.D., Medical College of Georgia, 1974.

Gregory I. Goldberg, Ph.D., Weizmann Institute of Science, 1977. (See Department of Medicine.)

Research Assistant

Richard J. McDonald

**DEPARTMENT OF
NEUROLOGY AND
NEUROLOGICAL
SURGERY**



NEUROLOGY AND NEUROLOGICAL SURGERY

Neurology and neurological surgery concern themselves with the diseases of brain, spinal cord, peripheral nerves, and muscles. An introduction to the anatomy and physiology of the nervous system is presented in the first-year course in neural sciences provided by the Departments of Anatomy and Neurobiology and of Cell Biology and Physiology. In the second year, the department presents the course in Pathophysiology of Nervous System Disorders. Here are demonstrated the interrelationships between knowledge derived from basic investigative and clinical sources. The Department also participates in the Preparation for Clinical Medicine course. In addition, there are lectures and exercises with patients in neurological physical diagnosis. A full-time, four-week clerkship in the third year, with collaborative teaching by both Neurology and Neurological Surgery services, introduces the phenomenology of the diseased nervous system. In the fourth year, there are opportunities for clinical externships and many varieties of research experience.

Several groups of faculty members are established for specialized research and teaching purposes. They include:

James L. O'Leary Division of Experimental Neurology and Neurological Surgery, *Dr. Woolsey* (Director).

Division of Neuropsychology, *Dr. Petersen* (Acting Director), *Drs. Crosson, Deuel*.

Division of Pediatric Neurology, *Dr. Volpe* (Director), *Drs. Deuel, Dodge, Dodson, Holowach Thurston, Noetzel, Prensky, Rothman*.

Division of Clinical Neuropharmacology, *Dr. Ferrendelli* (Director), *Drs. Clifford, Dodson, Miller*.

Division of Neuromuscular Diseases, *Dr. Pestronk* (Director), *Drs. Eliasson, Nemeth, Snider, Ms. Florence*.

Groups concerned with particular neurological illness research areas include:

Cerebral Circulation and Metabolism, *Drs. Grubb, Perlmutter, Powers, Raichle, Rich, Snyder*.

Convulsive Disorders, *Drs. Clifford, Dodson, Ferrendelli, Goldring, Miller, Snyder*.

Demyelinating Diseases, *Drs. Agrawal, Trotter, Van der Veen*.

Disorders of Movement, *Professor Clare, Drs. Landau, Montgomery, Perlmutter, Sabrmann, Schieber, Thach*.

Memory, Aging, and Dementia, *Drs. Berg, Cohen, Ducek, Morris, Raichle, Storandt*.

Metabolic Diseases of Children, *Drs. Dodson, Noetzel, Prensky*.

Areas of Neurosurgical specialization include:

Epilepsy Surgery, *Dr. Goldring*.

Pituitary Surgery, *Dr. Coxe*.

Pediatric Neurosurgery, *Dr. Coxe*.

Cerebrovascular Surgery, *Drs. Grubb, Rich*.

SECOND YEAR

Neurological Pathophysiology and Introduction to Clinical Neurology and Neurological Surgery

Lectures, demonstrations, and case conferences covering disease mechanisms.

Neurology-Neurosurgery Staff

Neurological Examination in Clinical

Diagnosis (part of interdepartmental course in clinical diagnosis)

Lectures, demonstrations, and practice examinations of neurological patients. *Dr. Eliasson and Staff*

THIRD YEAR

Combined Neurology-Neurosurgical Clerkship

A full-time, four-week clerkship is provided on the neurology services at Barnes, St. Louis Regional Medical Center, and on the Barnes Hospital neurosurgical service. Patients are assigned to students who follow them with the resident staff and discuss them regularly in conferences with the senior neurological and neurosurgical staff. Students also work in the neurology and neurosurgical clinics under staff supervision. *Drs. Eliasson, Landau, Goldring, and Staff*

FOURTH YEAR ELECTIVES

Research

A 6- to 12-week elective is available in many areas such as neuroanatomy, neurophysiology, cerebral metabolism and circulation, neurochemistry, neuropharmacology, etc. Facilities are available for qualified students in any year to undertake original research in the laboratories of the department or in the clinics and wards. *Drs. Goldring, Landau, and combined Neurology-Neurosurgery Staff*

Clinical Neurology/Consult Neurology

A four-week elective is offered at Barnes Hospital. The student works directly with the consult resident and senior staff covering consultations. Selected reading assignments on current topics in neurology. *Dr. Eliasson and Staff*



Clinical Neurosurgery

The goal of the six-week clerkship at Barnes Hospital is to provide an overview of neurological surgery. Responsibilities include patient workup, pre- and post-operative care, and attendance at selected neurosurgical operations. Daily teaching rounds are held with a member of the attending staff. Students also work in the Neurosurgical Clinic and attend the weekly staff conferences. *Dr. Goldring and Staff*

Staff Conferences

Students are invited to attend the Conjoint Neurological Conference (neuropathology, neuroradiology, medical neurology, pediatric neurology, and neurological surgery) held on Wednesday at 1:30 p.m. in the West Pavilion Auditorium. Once each month the conference is held at the St. Louis Regional Medical Center. The format of the conferences includes clinical presentations, symposia, and CPCs. Neurosurgery Grand Rounds are held weekly at 7:15 a.m. on Wednesday in the Neurosurgery conference room, 511 McMillan Hospital. Professors' rounds in Neurosurgery are held at 8:00 a.m. on Saturday in the Neurosurgical ICU on 10400.

Faculty

Co-Heads of Department

Sidney Goldring, William M. Landau

NEUROLOGY

Andrew B. and Gretchen P. Jones Professor of Neurology and Head

William M. Landau, M.D., Washington University, 1947.

Professor and Vice Chairman of Neurology

Sven G. Eliasson, Ph.D., University of Lund, 1952; M.D., 1954.

Seay Professor of Clinical Neuropharmacology

James A. Ferrendelli, M.D., University of Colorado, 1962. (See Departments of Pharmacology and Ophthalmology and Visual Sciences, and Neurological Surgery.)

Allen P. and Josephine B. Green Professor of Pediatric Neurology

Arthur L. Pinsky, M.D., New York University, 1955. (See Department of Pediatrics.)

A. Ernest and Jane G. Stein Professor of Developmental Neurology

Joseph J. Volpe, M.D., Harvard University, 1964. (See Departments of Biochemistry and Molecular Biophysics and Pediatrics.)

August A. Busch, Jr., Professor Emeritus of Neurological Surgery and Lecturer

Henry G. Schwartz, M.D., Johns Hopkins University, 1932.

Professors Emeriti

Jack Botwinick (Psychology), Ph.D., New York University, 1953. (Also Department of Psychology.)

Jean H. Thurston (Neurochemistry), M.D., University of Alberta, 1941. (See Department of Pediatrics.)

Edward E. Vastola, M.D., Columbia College of Physicians and Surgeons, 1947.

Professors

Harish C. Agrawal (Neurochemistry), Ph.D., Allahabad University, 1964. (See Departments of Pathology and Pediatrics.)

Leonard Berg, M.D., Washington University, 1949.

Margaret H. Clare (Neurophysiology), M.A., Washington University, 1951.

Ruthmary K. Deuel, M.D., Columbia College of Physicians and Surgeons, 1961. (See Department of Pediatrics.)

Philip R. Dodge, M.D., University of Rochester, 1948. (See Department of Pediatrics.)

W. Edwin Dodson, M.D., Duke University, 1967. (See Department of Pediatrics.)

Carlton C. Hunt (Neurophysiology), M.D., Cornell University, 1942. (See Department of Cell Biology and Physiology and Neurological Surgery.)

Alan L. Pearlman, M.D., Washington University, 1961. (See Department of Cell Biology and Physiology.)

Alan Pestronk, M.D., Johns Hopkins University, 1970.

Marcus E. Raichle, M.D., University of Washington, 1964. (See Department of Radiology.) (Also School of Engineering and Applied Science)

Martha Storandt (Psychology), Ph.D., Washington University, 1966. (Also Department of Psychology)

W. Thomas Thach, Jr., M.D., Harvard University, 1964. (See Department of Anatomy and Neurobiology.)

Thomas A. Woolsey (Neuroscience), M.D., Johns Hopkins University, 1969. (George H. and Ethel R. Bishop Scholar in Neuroscience in Neurology and Neurological Surgery.) (See Neurological Surgery and Departments of Anatomy and Neurobiology, and Cell Biology and Physiology.)

Research Professor

Kenneth B. Larson (Biomedical Computing), Ph.D., Massachusetts Institute of Technology, 1964. (See Institute for Biomedical Computing.)

Professors (Clinical)

Herbert E. Rosenbaum, M.D., University of Oregon, 1949.

E. Robert Schultz, M.D., Washington University, 1955. (See Department of Psychiatry.)

Stuart Weiss, M.D., Washington University, 1954.

Associate Professors

David B. Clifford, M.D., Washington University, 1975. (Starkloff Hospital)

Lawrence A. Coben, M.D., Western Reserve University, 1954. (Also Computer Systems Laboratory)

William F. Hickey, M.D., University of Vermont, 1977. (See Department of Pathology.)

Mary I. Johnson, M.D., Johns Hopkins University, 1968. (See Departments of Anatomy and Neurobiology and Pediatrics.)

William J. Powers, M.D., Cornell University, 1975. (Jewish Hospital) (See Department of Radiology.)

Steven M. Rothman, M.D., State University of New York, Upstate, 1973. (See Departments of Anatomy and Neurobiology and Pediatrics.)

Shirley A. Sahrman (Neurophysiology), Ph.D., Washington University, 1973. (See Department of Cell Biology and Physiology and Program in Physical Therapy.)

John L. Trotter, M.D., Washington University, 1969. (Gordon R. and Thelma B. Coates Scholar in Neurology)

Research Associate Professors

Bruce A. Crosson, Ph.D., Texas Tech University, 1978. (See Department of Psychiatry.)

Lyndon S. Hibbard (Neuroscience Imaging), Ph.D., Michigan State University, 1977.

Patti M. Nemeth (Myochemistry), Ph.D., University of California, 1977. (See Department of Anatomy and Neurobiology.)

Associate Professors (Clinical)

Joseph T. Black, M.D., State University of New York, Upstate, 1965.

Octavio de Marchena, M.D., Johns Hopkins University, 1976.

Joseph M. Dooley, Jr., M.D., St. Louis University, 1958.

Richard S. Sohn, M.D., University of Chicago, 1968.

Assistant Professors

M. Carolyn Baum, M.A., Webster College, 1979. (See Program in Occupational Therapy.)

Peter T. Fox, M.D., Georgetown University, 1979. (See Department of Radiology.)

John W. Miller, M.D., University of Illinois, 1977.

Mark A. Mintun, M.D., Washington University, 1981. (See Department of Radiology.)

Erwin B. Montgomery, Jr., M.D., State University of New York, Buffalo, 1976.

John C. Morris, M.D., University of Rochester, 1974. (See Department of Pathology.) (Jewish Hospital)

Michael J. Noetzel, M.D., University of Virginia, 1977. (See Department of Pediatrics.)

Dennis D. M. O'Leary (Neurobiology), Ph.D., Washington University, 1983. (See Department of Anatomy and Neurobiology and Neurological Surgery.)

Gary D. Paige, Ph.D., University of Chicago, 1980; M.D., 1981. (See Departments of Ophthalmology and Visual Sciences and Otolaryngology.)

Joel S. Perlmutter, M.D., University of Missouri, Columbia, 1979. (See Department of Radiology.)

Steven E. Petersen (Neuropsychology), Ph.D., California Institute of Technology, 1981. (See Neurological Surgery.)

Marc H. Schieber, Ph.D., Washington University, 1982; M.D., 1982. (See Department of Anatomy and Neurobiology.)

William D. Snider, M.D., University of North Carolina Medical School, 1977.

Abraham Zvi Snyder, Ph.D., The Rockefeller University, 1977; M.D., State University of New York at Buffalo, 1981.

Selden E. Spencer, M.D., University of North Dakota, 1978.

Research Assistant Professors Emeriti

Joe Inukai (See Neurological Surgery.)

Lloyd N. Simpson (See Neurological Surgery.)

Research Assistant Professors

Julaine Florence, MHS, Washington University, 1983.

James McCasland (Experimental Neurology), Ph.D., California Institute of Technology, 1983. (See Neurological Surgery.)

Gordon L. Shulman (Neuropsychology), Ph.D., University of Oregon, 1979. (Also Department of Psychology)

Tom O. Videen (Neurophysiology), Ph.D., University of Washington, 1981. (See Department of Radiology.)

Assistant Professors (Clinical)

Garrett C. Burris, M.D., University of Southwestern Louisiana, 1968. (See Department of Pediatrics.)

Richard J. Ferry, M.D., St. Louis University, 1962.

Joseph Hanaway, M.D., McGill University, 1960; C.M., 1960.

William B. Hardin, M.D., University of Texas Medical School at Galveston, 1957.

J. Michael Hatlelid, M.D., Washington University, 1977.

Walter Lemann, M.D., Tulane University, 1979.

Robert P. Margolis, M.D., St. Louis University, 1975.

David F. Mendelson, M.D., Indiana University, 1948.

David M. Reisler, M.D., Washington University, 1961.

James R. Rohrbaugh, M.D., Ohio State University, 1974. (See Department of Pediatrics.)

Eli R. Shuter, M.D., Washington University, 1960.

Howard I. Weiss, M.D., Tulane University, 1972.

Instructor Emeritus

Robert J. Mueller, M.D., Washington University, 1936.

Instructors

Denis I. Altman, M.B., University of the Witwatersrand, 1975. (See Department of Pediatrics.)

Robert S. Rust, Jr., M.D., University of Virginia School of Medicine, 1981. (See Department of Pediatrics.)

Research Instructors

David A. Carpenter, M.D., Washington University, 1983.

Mary A. Coats, B.S.N., Southern Illinois University Edwardsville, 1980.

Emily LaBarge, M.Ed., University of Missouri, 1980.

Francis M. Miezin

(Neuropsychology), M.S.,
University of Wisconsin, 1972.

Rebecca Rengo, M.A., M.S.W.,
Ohio State University, 1982.

Lee W. Tempel, M.D., University
of Washington, 1981.

Roelof van der Veen, Ph.D.,
University of Nymegan, 1988.

Instructors (Clinical)

Sylvia Awadalla, M.D., Ohio State
University, 1985.

John F. Mantovani, M.D.,
University of Missouri, Columbia,
1974. (See Department of
Pediatrics.)

Karen J. Pentella, M.D., Ohio
State University, 1979.

Daniel Phillips, M.D.,
Washington University, 1980.

Research Associates

Steven R. Buchholz (See
Neurological Surgery.)

Benjamin Rosser, Ph.D.,
University of Guelph, 1986.

Sanjay Sesodia, Ph.D., Muscular
Dystrophy Group Research Labs,
1986.

Research Assistants

Meena Dhawan, Ph.D.,
University of Delhi, 1984.

Maureen J. Fusselman, M.S., St.
Louis University, 1978. (See
Department of Radiology.)

Rebecca Kimmel, M.S.C.S.,
Washington University, 1987.

Ann C. McKeon, B.S., Boston
College, 1975.

JoAnne D. Scarpellini, B.S.,
Indiana State University, 1953.

Jeanne M. Smith (See
Neurological Surgery.)

**NEUROLOGICAL
SURGERY**

Professor and Head

Sidney Goldring, M.D.,
Washington University, 1947.

August A. Busch, Jr., *Professor
Emeritus and Lecturer*

Henry G. Schwartz, M.D., Johns
Hopkins University, 1932.

Professors

William S. Coxe, M.D., Johns
Hopkins University, 1948.

James A. Ferrendelli, M.D.,
University of Colorado, 1962.
(See Neurology and Departments
of Pharmacology and
Ophthalmology and Visual Sciences.)

Mokhtar Gado, DMRE, Cairo
University, 1960. (See Department
of Radiology.)

Robert L. Grubb, Jr., M.D.,
University of North Carolina, 1965.
(See Department of Radiology.)

Carlton C. Hunt, M.D., Cornell
University, 1942. (See Department
of Cell Biology and Physiology
and Neurology.)

Thomas A. Woolsey, Johns
Hopkins University, 1969. (Ethel R.
and George H. Bishop Scholar in
Neuroscience) (See Neurology and
Departments of Anatomy and
Neurobiology and Cell Biology
and Physiology.)

Assistant Professors

Kerry L. Bernardo, M.D.,
University of California, Los
Angeles, 1981.

Andreas H. Burkhalter, Ph.D.,
University of Zurich, 1977. (See
Department of Anatomy and
Neurobiology.)

Dennis D. M. O'Leary, Ph.D.,
Washington University, 1983. (See
Department of Anatomy and
Neurobiology and Neurology.)

Keith M. Rich, M.D., Indiana
University, 1977.

**Research Assistant
Professor**

Gary W. Harding, M.S.E.,
University of Washington, 1984.

Research Assistants

Isaac A. Edwards

Karl L. Probst

Jeanne M. Smith
(See Neurology.)

**DEPARTMENT OF
OBSTETRICS AND
GYNECOLOGY**



OBSTETRICS AND GYNECOLOGY

The student's involvement in obstetrics and gynecology consists of a thorough exposure to the basic concepts in reproductive biology and an active participation in the delivery of medical care to women with gestations normal or at risk, congenital anomalies of pelvic viscera, structural disorders secondary to difficult childbirth, reproductive endocrinopathies and infertility, and gynecologic malignancies. The third-year clerkship is conducted at Barnes Hospital, Jewish Hospital, and St. Louis Regional Hospital, with the majority of the students stationed at Barnes. Fourth-year electives may be taken at Barnes Hospital or in the many affiliated hospitals in St. Louis. Regularly held conferences in reproductive biology, perinatal medicine, ob-gyn pathology, and oncology supplement the student's education.

SECOND YEAR

Second-year students are introduced to obstetrics and gynecology with lectures in reproductive biology which apply the pelvic anatomy and physiology taught in the first year, physiology of tubal transport and ovarian control, myometrial function, placental perfusion, steroidogenesis, genetics, and prenatal diagnosis.

THIRD YEAR

Students are assigned to a resident-staff team, and the residents and staff physicians serve as preceptors during the student's six-week stay in the department. Every woman seen in the office or cared for in the hospital by the team of physicians is considered in her entirety. Attention is paid to the manner in which her social and economic situation has modified her response to disease. Environmental manipulation, in addition to traditional medical care, is prescribed to improve her health. The team method ensures that personalized care is given by arranging for the same group of physicians to meet a woman's health needs during each visit. The residents in a team function like a group in obstetrics and gynecology practice, and the student works like an intern in the specialty. The student sees patients in the office with the resident group, attends deliveries, assists in surgery, goes to conferences, and takes night call with them as part of the team.

FOURTH YEAR

Fourth-year students wishing to take an externship or research elective can choose from a variety of courses:

Ob-Gyn Subinternships

(A) Endocrinology Infertility Subinternship. In the office and hospital, the extern participates in the study and treatment of women with reproductive endocrine disorders and infertility. The extern presents patients in conferences, has assigned reading, and obtains experience in the techniques of steroid and gonadotropin quantitation as well as various manipulative procedures. *Dr. Warren*

(B) Pathology Subinternship. The elective elucidates the principles of anatomic pathology as applied to operative material in obstetrics and gynecology. The extern examines gross and microscopic specimens in the Ob-Gyn Pathology Laboratory and reviews pertinent literature with a senior pathologist. *Dr. Gersell*

(C) Gyn Oncology Subinternship. This elective concerns itself with the diagnosis and treatment of malignant tumors of the female reproductive tract. The extern is involved in all aspects of the care of women with gyn malignant tumors. This experience will include the surgical treatment, radiation therapy, and chemotherapy. *Dr. Camel*

(D) Perinatal Medicine Subinternship. Electronic and biochemical surveillance of the human fetus and mother before and during parturition. The extern is involved in the care of women with gestations at risk (i.e., diabetes, hypertension, toxemia, renal disease, fetopelvic disproportion, etc.). *Dr. Petrie*





(E) Ob-Gyn Preceptorship. Students who participate in this preceptorship spend six weeks with a clinical faculty member who is in private practice. They make hospital rounds and operate with their preceptors at Barnes and other community hospitals. The student becomes familiar with the experiences of the private practitioner. *Dr. Warren*

(F) Obstetric Anesthesiology. In this clinical elective, students receive instruction in the fundamentals of obstetric pain relief and newborn infant management and resuscitation. The pharmacology of sedatives, tranquilizers, narcotics, local anesthetics, inhalation, and intravenous drugs is demonstrated by practical application, emphasizing fetal-maternal implications in the management of labor. Special local anesthetic blocks such as caudal, lumbar epidural, and saddle spinal. Experience is also gained in the management of general anesthesia for minor gynecologic procedures such as postpartum tubal ligations.

Anesthesia Staff

(G) General Ob-Gyn Subinternships. St. Louis Regional Medical Center. The externship in this affiliated hospital allows the student a greater degree of participation and responsibility in the care of patients. There is a wealth of clinical material in this facility. *Dr. Staisch*

Research Electives

(A) Molecular Aspects of Endocrinology and Population Control. The research involves the study of the topography of macromolecular steroid binding sites, evaluation of the role of steroid "receptor" proteins in molecular mechanisms of steroid action, and the synthesis of affinity-labeling steroids and anti-steroids and their application to disease states and population control. *Dr. Warren*

(B) Regulation of Placental Hormone Synthesis. The laboratory is concerned with studying the factors regulating the biosynthesis of protein hormones in the placenta, human placental lactogen (hPL), and human chorionic gonadotropin (hCG). The appearance of these hormones in maternal serum differs markedly. For these studies the template mRNAs have been isolated and we are generating complementary DNAs to the corresponding mRNAs. These DNA probes will be used to assay gene activities in normal and pathological tissues. Students will be concerned with the concepts and techniques of molecular biology as applied to the above research. *Dr. Boime*

(C) Sperm Biochemistry and Andrology. Research is performed which is aimed at the understanding and control of the molecular events which allow for sperm penetration of the ovum. Investigations into male infertility centering on sperm motility, bacteriological considerations, and freezing of semen are also conducted. *Dr. Polakoski*

(D) Bio-Organic Chemical Endocrinology. The mechanism of steroid hormone action at the molecular level is approached by producing new progesterone and estrogen analogs by organic synthesis. The student can work at the organic synthetic or biochemical level. Isolation of uterine estrogen and progesterone receptor proteins by a newly synthesized affinity chromatography system is in progress. Also, new steroids containing alkylating functional groups are synthesized and have a dual research role: to serve as tools with which to probe the steroid-macromolecular binding phenomenon and to produce biologically active steroids with persistent hormone activity or hormone blocking action. Physicochemical methods are used to study steroid-protein interaction. *Dr. Sweet*

(E) Cell Biology and Immunology. The research involves the *in vitro* and *in vivo* analysis of tumor cells with particular emphasis on the relationship between the host immune system and the growth of tumorigenic cells. Two systems are currently used to facilitate this analysis. A mouse model system in which tumorigenic cells are induced by chemical car-

cinogens and a human system in which tumors, derived from patients, are established as cell lines *in vitro*. A variety of immunological and biological techniques are utilized and the student is encouraged to participate in ongoing research as well as to understand the conceptual framework on which the research is based. *Dr. Collins*

Faculty

Professor and Head of Department

James C. Warren, M.D., University of Kansas, 1954; Ph.D., University of Nebraska, 1961. (See Department of Biochemistry and Molecular Biophysics.)

Professors Emeriti

Willard M. Allen, M.D., University of Rochester, 1932; Sc.D. (hon.), Hobart College, 1940; Sc.D. (hon.), University of Rochester, 1957.

Walter G. Wiest, Ph.D., University of Wisconsin, 1952.

Professors

Irving Boime, Ph.D., Washington University, 1970. (See Department of Pharmacology.)

H. Marvin Camel, M.D., Creighton University, 1950.

James P. Crane, M.D., Indiana University, 1970. (See Department of Genetics.)

Ernst R. Friedrich, M.D., University of Heidelberg, 1954.

Ming-Shian Kao, M.D., National Taiwan University Medical College, 1961.

Roy H. Petrie, M.D., Vanderbilt University, 1965; Sc.D., Columbia University, 1984.

Kenneth V. Polakoski, Ph.D., University of Georgia, 1972.

Ronald C. Strickler, M.D., University of Toronto, 1967.

Frederick Sweet, Ph.D., University of Alberta, 1968.

Professors Emeriti (Clinical)

A. Norman Arneson, M.D., Washington University, 1928. (See Department of Radiology.)

John E. Hobbs, M.D., Washington University, 1927.

Frank B. Long, Jr., M.D., Washington University, 1947.

Melvin A. Roblee, M.D., Washington University, 1925.

Professors (Clinical)

Robert Burstein, M.D., Washington University, 1948.

William H. Masters, M.D., University of Rochester, 1943.

Associate Professor Emeritus

George J. L. Wulff, Jr., M.D., Washington University, 1933.

Associate Professors Emeriti (Clinical)

Robert S. Goell, M.D., Washington University, 1960.

James Pennoyer, M.D., University of Rochester, 1939.

Associate Professors

Jacques Sauvage, M.D., University of Liege, 1957.

Klaus J. Staisch, M.D., Free University of Berlin, 1966.

Associate Professors (Clinical)

S. Michael Freiman, M.D., Washington University, 1955.

Andrew E. Galakatos, M.D., University of Missouri, 1965.

J. Barlow Martin, M.D., Washington University, 1955.

Norman K. Muschany, M.D., Temple University, 1951.

Marvin Rennard, M.D., Washington University, 1952.

Melvin M. Schwartz, M.D., University of Nebraska, 1947.

Eugene D. Taylor, M.D., Howard University, 1954.

Assistant Professors

Erol Amon, M.D., Northwestern University, 1979.

Jeffrey M. Dicke, M.D., Ohio State University, 1978.

Michael J. Gast, M.D., Ohio State University, 1973; Ph.D., Washington University, 1981.

Asko I. Kivikoski, M.D., University of Turku, 1958; D.Sc., 1967.

Carolyn M. Martin, M.D., Washington University, 1976.

David G. Mutch, M.D., Washington University, 1980.

D. Michael Nelson, M.D., Washington University, 1977; Ph.D., 1977.

Michael J. Paul, M.D., Northwestern University, 1980.

Jorge Pineda, M.D., University of Honduras, 1972.

James S. Smeltzer, M.D., Case Western Reserve University, 1978.

Giuliana S. Songster, M.D., University of Utah, 1980.

Hung N. Winn, M.D., University of Illinois, 1982.

Research Assistant Professors

Sau Wai Cheung, Ph.D., Indiana University, 1975.



John L. Collins, Ph.D., University of Tennessee, 1976.

Terence Featherstone, Ph.D., University of Birmingham, England, 1980.

Gary L. Murdock, Ph.D., Medical University of South Carolina, 1976.

Assistant Professors Emeriti (Clinical)

William Berman, M.D., Washington University, 1935.

Arthur R. Bortnick, M.D., Washington University, 1935.

Arthur T. Esslinger, M.D., Washington University, 1940.

Willard C. Scrivner, M.D., Washington University, 1930.

Helman C. Wasserman, M.D., Washington University, 1932.

Assistant Professors (Clinical)

Robert L. Becker, M.D., Washington University, 1969.

Bruce L. Bryan, M.D., Washington University, 1977.

Robert S. Cohen, M.D., State University of New York, 1962.

C. Richard Gulick, M.D., University of Rochester, 1971.

Richard A. Hartman, M.D., University of Missouri, 1978.

Randall L. Heller, Jr., Ph.D., University of Missouri, 1968; M.D., University of Texas, 1976.

William L. Holcomb, Jr., M.D., Indiana University, 1975.

Darwin C. Jackson, M.D., Washington University, 1976.

Jacob Klein, M.D., Jefferson Medical College, 1968.

David J. Levine, M.D., Autonomous University of Guadalajara, 1976.

Jonathan R. Reed, M.D., Meharry Medical College, 1965.

Chotchai Srisuro, M.D., Faculty of Medical Sciences, 1967.

M. Bryant Thompson, M.D., University of California, 1961.

Albro C. Tobey, M.D., Trinity College, University of Dublin, 1972.

J. Leslie Walker, M.D., University of Tennessee, 1960.

Instructors

Diana L. Gray, M.D., University of Illinois, 1981.

Mazilu M. Havens, R.D.M.S.

Rebecca P. McAlister, M.D., University of Kentucky, 1979.

Diane F. Merritt, M.D.,
New York University, 1976.

Randall R. Odem, M.D.,
University of Iowa, 1981.

Nanette K. Rumsey, M.D.,
Northwestern University, 1985.

Instructors (Clinical)

Scott R. Barrett, Jr., M.D.,
Howard University, 1975.

James E. Belcher, M.D.,
Washington University, 1976.

Joe E. Belew, M.D., St. Louis
University, 1957.

Kathryn L. Botney, M.D.,
Washington University, 1984.

Robert J. Brown, M.D.,
Washington University, 1983.

Shih-Chung Chang, M.D.,
Chung-Shan Medical College, 1968.

Christine M. Cherry, M.D., Rush
University, 1983.

Ronald J. Chod, M.D.,
University of Texas Dallas, 1983.

Lauren E. Clark-Rice, M.D.,
University of Missouri, 1977.

Russell B. Dietrich, M.D.,
University of Illinois, 1970.

David E. Dugger, M.D.,
Vanderbilt University, 1976.

Cathleen R. Faris, M.D.,
University of Kansas, 1982.

Ira C. Gall, M.D., University of
Cincinnati, 1951.

Joseph Hazan, M.D., Ege
University Medical School, 1971.

Godofredo M. Herzog, M.D.,
Washington University, 1957.

William E. Houck, M.D.,
University of Cincinnati, 1981.

Laura R. Hulbert, M.D.,
Washington University, 1981.

Michael K. Johnson, M.D.,
St. Louis University, 1975.

Mark J. Jostes, M.D.,
University of Missouri,
Columbia, 1981.

James W. Kessel, M.D.,
University of Chicago, 1975; Ph.D.,
California Institute of Technology,
1963.

Justin F. Kraner, M.D.,
University of Michigan, 1949.

Darryl H. McKinney, M.D.,
Washington University, 1980.

Clifford G. Martin, M.D., Tulane
University, 1982.

Theodore M. Meiners, M.D.,
Washington University, 1948.

Theodore Merrims, M.D.,
Washington University, 1954.

Jerry N. Middleton, M.D.,
Washington University, 1963.

Sam Momtazee, M.D., Shiraz
Medical School, 1961.

Alvaro Mora, M.D., Antioquia
University.

Vivian F. Moynihan, M.D., Ohio
State University, 1980.

Nathaniel H. Murdock, M.D.,
Meharry Medical College, 1963.

Gerald Newport, M.D.,
Washington University, 1953.

Joseph D. O'Keefe, M.D.,
Washington University, 1950.

Carlton S. Pearse, M.D.,
Washington University, 1978.

Louis T. Riley, M.D.,
University of Kentucky, 1980.

Chinda Vanasin Rojanasathit,
M.D., Siriraj Medical School, 1967.

Jerome D. Sachar, M.D.,
University of Missouri,
Columbia, 1979.

Daniel J. Semenoff, M.D.,
St. Louis University, 1963.

John A. Stoppie, M.D.,
University of Wisconsin, 1969.

Randall W. Tobler, M.D.,
Washington University, 1984.

Gary M. Wasserman, M.D.,
University of Missouri at Kansas
City, 1980.

Mark S. Wasserman, M.D.,
University of Missouri at Kansas
City, 1984.

Parker H. Word, M.D., Howard
Medical School, 1944.

Mitchell Yanow, M.D.,
Washington University, 1941.

**DEPARTMENT OF
OPHTHALMOLOGY
AND VISUAL
SCIENCES**



OPHTHALMOLOGY AND VISUAL SCIENCES

Instruction begins in the second year with methods of examination of the eye. Emphasis is on the use of the ophthalmoscope. There are also several lectures on various aspects of ocular disease. During the third year, students are assigned to an ophthalmology clerkship for one week. In the fourth year, six-week and twelve-week clinical or research electives are offered.

SECOND YEAR

Introduction to clinical ophthalmology begins in the second year with a lecture and practicum (peer exam) on taking an ocular history and performing an ocular exam. Emphasis is on the use of the ophthalmoscope. Additionally, during the second year, there is a series of lectures on various aspects of ocular disease. The emphasis is on ocular manifestations of common systemic diseases, e.g. diabetic retinopathy, hypertensive retinopathy, optic neuritis, papilledema, Grave's ophthalmopathy, etc., as well as common eye diseases, e.g. cataracts and glaucoma. This series of lectures is presented as case problems on which students work prior to the lecture. This "problem-solving" approach has proved to be more successful and more informative than the strict didactic lecture approach. *Dr. M. Smith and Staff*

THIRD YEAR

In the third year, all students (six at a time) spend one week in the outpatient eye clinic examining patients with ophthalmology residents. During this week, the students have discussion sessions on

various topics with members of the faculty, e.g., differential diagnosis of the "red eye," how to interpret an ophthalmologic consult note, how to handle an ocular emergency in the emergency room (chemical burns, etc.). During this one week, there is again emphasis on the use of the ophthalmoscope, and a problem solving case history-photo album is worked on by the students. *Dr. M. Smith and Staff*

FOURTH YEAR ELECTIVE

The fourth year is a clinical clerkship geared to the student who plans to enter the specialty of ophthalmology. The student's role is that of an extern in that he/she performs the history and ocular exam on patients in the outpatient clinic and/or the various services within the department, e.g. University Eye Service, glaucoma unit, neuroophthalmology unit, etc. The student is expected to present cases at rounds and conferences. There are one or two students on each of these services for six or twelve weeks.

Dr. M. Smith and Staff

RESEARCH ELECTIVES

Biochemical approaches to study visual transduction in photoreceptors; Retinal neurochemistry and pharmacology. *Dr. Blazynski*

Biophysical studies on photoreceptors using optical and electrophysiological techniques; instrumentation and computing for biophysical studies; biochemical studies of photoreceptor transduction. *Dr. J. Brown*

Regulation of the immune response; ocular immunology. *Dr. Ferguson*

Research in external ocular disease and corneal surgery. *Dr. Gans*



Compliance to medical therapy using unobtrusive electronic monitors. *Dr. Gordon*

Computer applications in visual fields. *Dr. Hart*

Organization of lens crystalline genes; transcriptional regulation of lens genes. *Dr. Hay*

Ocular Immunology: immunologic studies of uveitis; regulation of the antibody response after intraocular sensitization. *Dr. Kaplan*

Physiology of equilibrium control. Studies of visual, vestibular, and somatosensory interactions in maintaining postural stability and in controlling eye movements; and adaptive plasticity in postural and oculomotor control. *Dr. Paige*

Ocular inflammation and infection with focus:

- 1) Molecular virology, pharmacology, and immunology of Herpes Simplex; 2) Cytokines and MHC class II activation of corneal allograft rejection; 3) Ocular manifestations of AIDS. *Dr. Pepose*

Molecular genetics and biology of cataracts; development of enzyme inhibitors for prevention of diabetic cataract. *Dr. Petrach*

Electrophysiology and biochemical regulation of active ion transport across isolated corneal epithelium; DC electrical measurement of transepithelial and intracellular parameters; homeostatic regulation of Ca in membrane. *Dr. Reinach*

Psychophysical and neurophysiologic studies of visual loss. *Dr. Trick*

Faculty

Professor and Head of Department

Henry J. Kaplan, M.D., Cornell University, 1968.

Professor Emeritus

Robert A. Moses, M.D., University of Maryland, 1942.

Professors

Bernard Becker, M.D., Harvard University, 1944.

Joel E. Brown, Ph.D., Massachusetts Institute of Technology, 1964. (See Departments of Cell Biology and Physiology and Anatomy and Neurobiology.)

Adolph I. Cohen, Ph.D., Columbia University, 1954. (See Department of Anatomy and Neurobiology.)

Nigel W. Daw, Ph.D., Johns Hopkins University, 1967. (See Department of Cell Biology and Physiology.)

James A. Ferrendelli, M.D., University of Colorado, 1962. (See Departments of Pharmacology and Neurology and Neurological Surgery.)

William M. Hart, Jr., Ph.D., University of Maryland, 1970; M.D., 1970.

Michael A. Kass, M.D., Northwestern University, 1966.

Allan E. Kolker, M.D., Washington University, 1957.

Morton E. Smith, M.D., University of Maryland, 1960. (See Department of Pathology.)

Professors (Clinical)

Robert C. Drews, M.D., Washington University, 1955.

Benjamin Milder, M.D., Washington University, 1939.

James E. Miller, M.D., Medical College of Alabama, 1949. (See Department of Pediatrics.)

Edward Okun, M.D., University of Vermont, 1956.

Stephen R. Waltman, M.D., Yale University, 1964.

Associate Professor

Jay S. Pepose, Ph.D., University of California, Los Angeles, 1980; M.D., 1982. (See Department of Pathology.)

Associate Professors Emeriti (Clinical)

Howard R. Hildreth, M.D., Washington University, 1928.

Theodore E. Sanders, M.D., University of Nebraska, 1933.

Associate Professors (Clinical)

Neva P. Arribas, M.D., Manila Central University, 1954.

George M. Bohigian, M.D., St. Louis University, 1965.

Isaac Boniuk, M.D., Dalhousie University, 1962.

Dean B. Burgess, M.D., University of California, 1967.

Richard F. Escoffery, M.B., B.S., University of West Indies Medical School, 1969.

M. Gilbert Grand, M.D., Yale University, 1968.

Jack Hartstein, M.D., University of Cincinnati, 1955.

Glen P. Johnston, M.D., Washington University, 1956.

Jack Kayes, M.D., Washington University, 1957.

Harry L. Knopf, M.D., Harvard Medical School, 1967.

Terence G. Klingele, M.D., University of California, 1970.

Robert Joseph Olk, M.D., Rush Medical College, 1975.

Harry D. Rosenbaum, M.D., Washington University, 1934.

Bernd Silver, M.D., University of Louisville, 1956.

Assistant Professors

Christine Blazynski, Ph.D., Purdue University, 1981.

Fred C. Chu, M.D., Cornell University, 1971. (See Department of Pediatrics.)

William J. Dinning, M.D., Royal College of Surgeons of England, 1972.

Thomas A. Ferguson, Ph.D., University of Cincinnati, 1982. (See Department of Pathology.)

Lawrence A. Gans, M.D., Case Western Reserve University, 1977.

Melvin Haber, M.D., New York Medical College, 1963. (See Department of Anesthesiology.)

Gary D. Paige, Ph.D., University of Chicago, 1980; M.D., 1981. (See Departments of Neurology and Neurological Surgery and Otolaryngology.)

J. Mark Petrash, Ph.D., University of Texas, Galveston, 1981. (See Department of Genetics.)

Peter Reinach, Ph.D., New York University, 1972.

Gary L. Trick, Ph.D., Indiana University, 1978.

Lawrence Tychsen, M.D., Georgetown University.

Research Assistant Professors

Er-Kai Gao, M.D., Peking Medical College, 1983.

Mae Gordon, Ph.D., University of Wisconsin, 1978. (See Division of Biostatistics.)

Regine E. Hay, Ph.D., North Carolina State University, 1974.

Assistant Professors Emeriti (Clinical)

William H. Meinberg, M.D., Washington University, 1932.

Lawrence T. Post, Jr., M.D., Washington University, 1948.

Philip Venable, M.D., Wayne State University, 1940.

Assistant Professors (Clinical)

Stanley C. Becker, Ph.D., Washington University, 1951; M.D., Chicago Medical School, 1955.

Edward F. Berg, M.D., Washington University, 1964.

Ronald C. Bilchik, M.D., Washington University, 1967.

James C. Bobrow, M.D., Johns Hopkins University, 1970.

Samuel A. Canaan, Jr., M.D., Meharry Medical College, 1954.

Philip L. Custer, M.D., Vanderbilt University, 1978.

Robert M. Feibel, M.D., Harvard University, 1969.

James M. Gordon, M.D., University of Minnesota, 1966.

Michael J. Isserman, M.D., Washington University, 1975.

Stephen A. Kamenetzky, M.D., Washington University, 1970.

Robert L. Lamberg, M.D., Washington University, 1976.

Barry D. Milder, M.D., Washington University, 1973.

Matthew Newman, M.D., Columbia University, 1959.

F. Thomas Ott, M.D., Washington University, 1965.

John C. Perlmutter, M.D., Cornell University Medical College, 1971.

Michael B. Rumelt, M.D., Washington University, 1966.

Lawrence H. Schoch, M.D., University of Louisville, 1976.

Philip T. Shahan, M.D., Washington University, 1942.

Arthur W. Stickle, Jr., M.D., University of Oklahoma, 1943.

Matthew A. Thomas, M.D., Harvard Medical School, 1981.

William L. Walter, M.D., Ohio State University, 1954.

Charles E. Windsor, M.D., University of Rochester, 1960.

Mitchel L. Wolf, M.D., Albert Einstein College of Medicine, 1968.

Instructor

Lawrence S. Halperin, M.D., University of Pennsylvania, 1985.

Research Instructor

Gillian Roper-Hall, D.B.O.(D), Moorfield Eye Hospital, 1969; Certified Orthoptist, U.S. Board, 1973.

Instructor Emeritus (Clinical)

Maxwell Rachlin, M.D., University of Toronto, 1942.

Instructors (Clinical)

Nevinkumar J. Amin, M.B.B.S., Bombay University, 1966.

Bruce H. Cohen, M.D., Johns Hopkins Medical School, 1980.

Bruce S. Frank, M.D., Washington University, 1976.

Ruth S. Freedman, M.D., Washington University, 1942.

Kenneth O. Green, M.D., University of Missouri, 1960.

William S. Joffe, M.D., Washington University, 1963.

Robert W. Jones, M.D., Washington University, 1984.

Cynthia Z. Kenneally, M.D., University of Missouri, Columbia, 1982.

Mickey L. Salmon, M.D., Louisiana State University, 1959.

Mark H. Spurrier, M.D., Washington University, 1980.

Sara E. Stoneburner, M.D., Duke University, 1983.

Stephen A. Wexler, M.D., University of Michigan, 1982.

Assistants

Duane L. Mitzel, M.D., Washington University, 1977.

Louis J. Rosenbaum, M.D., Washington University, 1963.

Research Assistants

Dorothy G. Cooper, M.S.N., Washington University, 1966.

Nels J. Holmberg, M.S., Oklahoma State University, 1966.

Floyce A. Scherrer, R.N., Washington University, 1960.

**DEPARTMENT OF
OTOLARYNGOLOGY**



OTOLARYNGOLOGY

Otolaryngology is presented to students in the Second, Third, and Fourth Year Classes. A clinical pathologic correlation lecture series is presented to sophomores. In the third year of the medical curriculum, each student spends one week on one of the services in East Pavilion or St. Louis Veterans Administration. During this period there is teaching at the bedside, in the operating room, and in the clinic, supplemented by daily afternoon lectures, grand rounds on Wednesdays, and an introduction to audiology as well as to basic ENT research.

Fourth-year students who show a special interest may take a rotating elective in ENT suited to their interests. Some possibilities include research or clinical work. Ample research facilities and ongoing projects are available. Clinical exposure could include oncologic diseases related to the head and neck, otologic diseases, otoneurology, audiology, or middle-ear surgery.

The postgraduate program in Otolaryngology at Washington University School of Medicine consists of one year of general surgery and one year of research in otolaryngology. Following this, there are four years of otolaryngology. During the clinical years of training, residents rotate on various services, which include the Head and Neck Surgery Service at Barnes Hospital, the ENT Clinic, Otolaryngology, Plastic Surgery Service, the Veterans Administration Hospitals, Children's Hospital, Jewish Hospital, and St. Louis Regional Hospital. During that time, the resident serves in all aspects of patient care including the outpatient clinic, inpatient hospital care, and the operating room, as well as the various ENT diagnostic laboratories such as vestibular and audiology. There is an increasing degree of responsibility given to residents as they proceed during the training program, depending upon the year in training and also the resident's personal professional development during this time. Didactic teaching consists of a basic science course during the first year of clinical residency. There is also a temporal bone otology course, as well as a head and neck dissection course. Throughout the year, there are didactic lectures on a weekly basis. These lectures consist of Grand Rounds, Morbidity and Mortality Conference and a series of instructional lectures throughout the year which cover all aspects of otolaryngology. During the clinical years, residents are expected to participate in clinical and/or basic research and to publish papers in peer-reviewed journals and they are expected to make presentations at the lectures or Grand Rounds. They are encouraged to submit papers and to make presentations at regional and national otolaryngology meetings. There is a national course consisting of literature given by the American Academy of Otolaryngology in which residents are expected to participate throughout the year. There is



also an In-Training Examination given by the American Academy of Otolaryngology which all residents must take on a yearly basis. Throughout their residency, residents receive training in all aspects of otolaryngology including general otolaryngology, head and neck cancer surgery, microvascular reconstructive techniques, facial plastic surgery, pediatric otolaryngology including pediatric endoscopy, allergy and endoscopic nasal sinus surgery.

SECOND YEAR

Otolaryngology and Physical Diagnosis

Clinical pathologic correlative lectures in otolaryngology are given to the entire class. Subjects include ear disease, vertigo, nose, sinus and larynx problems and head and neck cancer. *Dr. Thawley*

THIRD YEAR

Otolaryngology Clerkship

Practical instruction in diagnosis and treatment. Students rotate on the ENT service. This consists of ENT Outpatient Clinic, in-hospital patients and the operating room. One week. *Dr. Thawley*

FOURTH YEAR ELECTIVES

Clinical Clerkship in Otolaryngology

Six week rotation includes evaluation of ENT problems presented to specialist for diagnosis and treatment. The student participates in the clinic, hospital and operating room. This also includes time on the Pediatric ENT Service, Audiology Voice Laboratory and Vestibular Evaluation Laboratory. Two students are accepted for each rotation. Students select their own options depending on their needs. *Dr. Thawley*

Practicum in Clinical Audiology

Guidance provided in the administration and interpretation of audiometric tests. Emphasis on defining the severity of auditory dysfunction in addition to

identifying sites of pathological processes. Theoretical bases of acoustics, anatomy and physiology, and electronics reviewed as they relate to auditory assessment. Modification of conventional test paradigms and hearing aid procedures covered according to each student's interests and needs. *Dr. Skinner*

Otoneurology

Attend Audiology Lab Tuesday and Thursday mornings. Attend Otoneurology Lab on Tuesday and Thursday afternoons. The student will follow through on patients (in the office and hospital) who are complaining of dysequilibrium or vertigo. *Drs. Goebel, Paige*

RESEARCH ELECTIVES

Inner ear microanatomy and pathology (light- and electron-microscopy). The effects of various ototraumatic agents (e.g., noise, radiation, etc.) on the structure of the inner ear are determined using light and electron microscopic evaluation of the cochlear tissues. *Dr. Bohne*

Topics in microvascular surgery.
Drs. Hayden, Fredrickson

Glass microelectrodes, intra- and extra-cellular labels, computers, light and electronmicroscopy are used to study aspects of the central and peripheral vestibular system with an emphasis on vestibular efferents in anesthetized and alert fish and squirrel monkeys. *Dr. Highstein*

Evaluation and treatment methods for disorders of the velopharynx and larynx in children. *Dr. Muntz*

Clinical laboratory diagnosis and research into normal and non-normal speech with special emphasis on voice disorders. Students will become familiar with diagnostic procedures and instrumental techniques. *Dr. Painter*

Computer based studies of head and neck cancer treatment and results. *Dr. Sessions*

Research in implantable hearing aids.
Drs. Skinner, Fredrickson

Current projects involve patch clamp recording technology and single channel analysis to study efferent control of the vestibular hair cell. Computer data acquisition and analysis. *Dr. Steinacker*

Extensive research regarding the clinical evaluation of disorders of the inner ear. The student will be actively performing clinical tests for vestibular function including electronystagmography and audiology. *Drs. Stroud, P. Smith*

Biochemistry and pharmacology of the inner ear.
Dr. Thalmann

Faculty

Lindburg Professor and Head of Department

John M. Fredrickson, M.D., University of British Columbia, 1957; FRCS(C), 1963; M.D. (hon.), Sweden, 1975.

Professor Emeritus

S. Richard Silverman (Audiology), Ph.D., Washington University, 1942. (Also Central Institute for the Deaf and Faculty of Arts and Sciences)

Professors

Barbara A. Bohne, Ph.D., Washington University, 1971.

George A. Gates, M.D., University of Michigan, 1959.

Stephen M. Highstein, M.D., University of Maryland Medical School, 1965; Ph.D., University of Tokyo Faculty of Medicine, 1976. (See Department of Anatomy and Neurobiology.)

Colin Painter, Ph.D., University of London, England, 1969.

Donald G. Sessions, M.D., Washington University, 1962.

Gershon J. Spector, M.D., University of Maryland, 1964.

Malcolm H. Stroud, M.D., Ch.B., University of Birmingham, 1945; L.R.C.P., M.R.C.S., 1946; F.R.C.S., 1949.

Ruediger Thalmann, M.D., University of Vienna, 1954.

Research Professors Emeriti and Lecturers

Hallowell Davis, M.D., Harvard University, 1922; Sc.D. (hon.), Colby College, 1954; Sc.D. (hon.), Northwestern University, 1962; Sc.D. (hon.), Washington University, 1973. (See Department of Cell Biology and Physiology.) (Also Central Institute for the Deaf)

Donald H. Eldredge, M.D., Harvard University, 1946. (Also Central Institute for the Deaf and Faculty of Arts and Sciences)

Research Professors

Ira J. Hirsh (Audiology), Ph.D., Harvard University, 1948. (Also Central Institute for the Deaf and Faculty of Arts and Sciences)

James D. Miller, Ph.D., Indiana University, 1957.

Professors Emeriti (Clinical)

Benard C. Adler, M.D.,
Washington University School of
Medicine, 1937.

Harold M. Cutler, M.D., Tufts
College, 1937

Professor (Clinical)

Morris Davidson, M.D., Indiana
University, 1938.

Associate Professors

Joseph E. Harvey (Experimental
Otolaryngology), Ph.D., University
of California, Berkeley, 1968.

Stanley E. Thawley, M.D.,
University of Texas Medical
Branch, 1967.

Research Associate Professor

A. Maynard Engebretson, D.Sc.,
Washington University, 1970.

Associate Professors Emeriti (Clinical)

Guerdan Hardy, M.D.,
Washington University, 1929.

Robert E. Votaw, M.D., State
University of Iowa, 1929.

Associate Professors (Clinical)

Carl F. Ehrlich, M.D., University
of Missouri, Columbia, 1965.

Charles C. Jacobs, M.D.,
Washington University, 1945.

Edward H. Lyman, M.D.,
Washington University, 1937.

Wayne A. Viers, M.D., University
of Oklahoma, 1956.

Joseph W. West, M.D., Duke
University, 1944.

Assistant Professors

Benjamin K. Finkelhor, M.D.,
Hahnemann University, 1982.

Dennis P. Fuller (Speech
Pathology), Ph.D., St. Louis
University, 1982.

Joel A. Goebel, M.D., Washington
University, 1980.

Bruce H. Haughey, M.B., Ch.B.,
University of Auckland, 1977.

Richard E. Hayden, M.D., C.M.,
McGill University, 1974.

Rodney P. Lusk, M.D., University
of Missouri, 1977. (See Department
of Pediatrics.)

Harlan R. Muntz, M.D.,
Washington University School of
Medicine, 1977. (See Department
of Pediatrics.)

Gary D. Paige, Ph.D., University
of Chicago, 1980; M.D., 1981. (See
Departments of Neurology and
Neurological Surgery and
Ophthalmology and Visual
Sciences.)

Alec N. Salt, Ph.D., University of
Birmingham, 1977.

Margaret W. Skinner, Ph.D.,
Washington University School of
Medicine, 1976.

Peter G. Smith, Ph.D., Purdue
University, 1972; M.D., Medical
University of South Carolina, 1976.

Antoinette Steinacker, Ph.D.,
University of the Pacific, San
Francisco, 1972. (See Department
of Anatomy and Neurobiology.)

J. Regan Thomas, M.D.,
University of Missouri, 1972.

Research Assistant Professor

Isolde Thalmann, Ph.D.,
California Western University,
1982.

Assistant Professor Emeritus (Clinical)

Donald R. Ingram, M.D.,
University of Illinois, 1956.

Assistant Professors (Clinical)

Sheldon Davis, M.D., University
of Michigan, 1973.

Norman S. Druck, M.D.,
University of Illinois, 1970.

Jeffrey Fierstein, M.D., Albert
Einstein College of Medicine, 1971.

Timothy N. Kaiser, M.D.,
Harvard University, 1982.

Roanne G. Karzon (Audiology),
Ph.D., Washington University,
1982.

Philip L. Martin, M.D., St. Louis
University, 1968.

Supote Phipatanakul, M.D.,
Chulalongkorn Hospital Medical
School, 1965.

Albert F. Ruehl, M.D., St. Louis
University School of Medicine,
1973.

Lloyd Thompson, M.D., Howard
University, 1964.

Michael Valente (Audiology),
Ph.D., University of Illinois, 1975.

Instructor Emeritus

Marion P. Bryan, A.B.,
Washington University, 1931.

Instructors (Clinical)

Gerald Bart, M.B.B.S., Karnatak
University, 1963.

J. Michael Conoyer, M.D.,
Vanderbilt University, 1975.

James A. Fernandez, M.D.,
St. Louis University School of
Medicine, 1981.

Virginia W. Jenison (Audiology),
M.A., CCC-A, University of
Tennessee, 1978.

John W. McKinney, M.D.,
University of Missouri, 1979.

Stephen B. Overton, M.D.,
University of Michigan, 1967.

Robert Ryan, Jr., M.D., St. Louis
University, 1973.

Richard E. Schrick, M.D.,
University of Missouri, Columbia,
1977.

Alan P.K. Wild, M.D., Tulane
University, 1983.

Research Instructors

Thomas H. Comegys, B.A.,
Central Methodist College, 1966.

John E. Demott, M.A., University
of Missouri, 1978.

Research Associates

William Clark, Ph.D., University
of Michigan 1975. (Also Central
Institute for the Deaf)

Timothy A. Holden, B.S.E.,
University of Iowa, 1984.

DEPARTMENT OF

PATHOLOGY



PATHOLOGY

Modern pathology is concerned with the molecular and ultrastructural basis of disease. Historically, morphologic studies provided the foundations of our concepts of disease, and ultrastructural studies continue to add to our understanding, but modern pathology utilizes virtually all of the tools of basic sciences. Pathologists are involved in diagnostic, teaching, and research activities.

In addition to the second year of pathology, the department conducts numerous combined conferences which third- and fourth-year students attend as part of individual clinical clerkships. These are described below.

Students, usually in their fourth year, may elect to participate in advanced courses or clerkships in autopsy or surgical pathology or laboratory medicine, or to pursue research in experimental pathology.

The department offers a course of study leading to the Ph.D. degree. Medical students who desire to combine graduate and medical programs of study should consult Dr. Jacques Baenziger.

For the purpose of teaching, research, and service, the department is divided into specialty divisions under the following directors:

Autopsy Pathology, *Dr. Saffitz*

Graduate Programs in Experimental Pathology,
Dr. Baenziger

Laboratory Medicine, *Dr. McDonald*

Neuropathology, *Dr. Hickey*

Pediatric Pathology, *Dr. Kissane*

Surgical Pathology, *Dr. L. Dehner*

SECOND YEAR

Bio 515, 516. General Pathology

This course is a comprehensive survey of the biology and morphology of human disease. The year begins with a review of basic mechanisms of disease at the cellular and molecular level. Subsequently, the characteristics of major pathologic entities affecting the organ systems of the human body are presented, employing both lectures and laboratory sessions. In the laboratories, small groups of students directly examine gross and microscopic specimens with the assistance of members of the faculty and housestaff. These exercises reinforce the material presented in lecture and give students an opportunity to acquire the basic skills required for making pathologic diagnoses. *Staff*

THIRD AND FOURTH YEARS

Clinical Pathological Conference

The clinical history and treatment of patients who have died are discussed before the class by the physicians and surgeons of the departments con-

cerned. These conferences afford students an opportunity to interpret the clinical observations in light of the postmortem findings. One hour a week during the year. *Staff*

Laboratory Medicine Conference

One hour each week for twelve weeks during Internal Medicine rotations. Problem cases and general principles of Laboratory Medicine are discussed. *Staff*

Tumor Conference

One hour each week for twelve weeks during the surgery and obstetrics and gynecology clerkships. Problem cases are presented for illustration and discussion of all aspects of neoplastic disease. *Staff*

RESEARCH

Bio 590. Research Opportunities

The department encompasses all of the major areas of investigation in experimental pathology. Examples include:

Biochemistry of protein handling in immune induction. *Dr. Allen*

Examination of glycoprotein oligosaccharides and their role in endocytosis and cellular recognition. *Dr. Baenziger*

Kinetics and hormonal aspects of neoplastic cell growth. Human neoplastic growth and spread. *Dr. Bauer*

Biochemistry of the skeleton, where needs for growth and remodeling are balanced with maintenance of calcium concentration in the circulation with emphasis on the biochemistry of the osteoclast. *Dr. H. Blair*

Mechanism of antigen recognition by cytolytic T lymphocytes. *Dr. Braciale*

Quantitative erythrocyte and platelet serology; immunoglobulins and complement subcomponents. *Dr. Chaplin*

Collagen metabolism and pulmonary pathology. *Dr. Crouch*

Academic surgical pathology. *Dr. L. Dehner*

Glucose metabolism in bacteria. *Dr. Dietzler*

Investigation on the immunological basis of diseases of the central nervous system. *Dr. Hickey*

Renal pathology, pediatric pathology. *Dr. Kissane*

Mechanisms of antimalarial action, malaria and red cell deformability. *Dr. Krogstad*

Vitamin D effects on lymphocyte activation. *Dr. D. Lacey*

Experimental diabetes mellitus, tissue culture of islets, transplantation of islets. *Dr. Lacy*



Development of monoclonal antibodies for assessing isoenzymes. *Dr. Ladenson*

Cell surface complement receptors--structure and function. *Dr. Lublin*

Experimental diabetes: biochemical studies of insulin release mechanisms in vitro. *Dr. McDaniel*

Biology of breast cancer. *Drs. McDivitt, Palmer*

Cellular mechanism of hormone action and intracellular Ca^{2+} metabolism. *Dr. McDonald*

Pathology of Alzheimer's Disease. *Dr. McKeel*

Developmental expression of genes regulated by nerve growth factor. *Dr. Milbrandt*

Molecular biology of blood coagulation. *Dr. Miletich*

Cell mediated immunity and systemic mycoses. *Dr. Moser*

Use of transgenic mice to examine lymphocyte activation. *Dr. K. Murphy*

Studies on antibiotic susceptibility of aerobic and anaerobic bacteria. *Dr. Murray*

Studies of human IgG subclass expression. *Dr. Nahm*

Statistical theory and computer technology applications in laboratory medicine. *Dr. Parvin*

Mechanisms regulating immune responses in tissue culture systems. Cellular immunology with particular emphasis on genetic control of antibody responses. *Drs. Pierce and Kapp-Pierce*

Characterization and role of neuropeptides. *Dr. K. Roth*

Experimental cardiovascular pathology; structure-function relationships in ischemic heart disease. *Dr. Saffitz*

Use of molecular probes in clinical pathology. *Dr. B. Saba*

Biochemical mechanisms of cell-substrate and cell-cell adhesion as manifest by blood platelets. *Dr. Santoro*

Pathogenesis of experimental diabetic autonomic neuropathy. *Dr. Schmidt*

Biochemistry and biology of lymphokines. *Dr. Schreiber*

Immunopathology of renal disease. *Dr. Schreiner*

Placental transport and surface membrane structure and function. *Dr. C. Smith*

Metabolic bone disease. *Dr. Teitelbaum*

Biochemistry and biology of leukocyte T-200 proteins. *Dr. Thomas*

Immunopathology of autoimmune diseases. *Dr. Tung*
Arachidonic acid biochemistry and the regulation of insulin secretion. *Dr. Turk*

Immunobiology and immunopathology of lymphocyte-macrophage interactions. *Dr. Unanue*

Cellular interactions in immunity. *Dr. C. Weaver*

Immunocytochemistry and electron microscopy. *Dr. M. Wick*

Vascular structure and function; pathophysiology of diabetic and ischemic vascular disease.
Dr. Williamson

ELECTIVES

Advanced Special Pathology

A series of seminars discussing timely selected topics in special pathology of human disease, augmented by illustrative cases and emphasizing clinicopathologic correlations. Reading lists will be circulated and active discussion is encouraged. If the size of the group makes it practical to do so, each student will prepare and conduct a session on a subject of their choice. *Dr. Kissane*

Autopsy Pathology

A full-time elective held during periods 4-8. Students assist in performing autopsies and participate fully in the activities of the Autopsy Service. Supervision is by faculty and housestaff pathologists. Emphasis is placed on the student learning as much gross pathology as possible as a preparation to be a pathologist or to serve as a general background in medical, surgical, and neurologic diseases. Weekly conferences include gross and microscopic neuropathology, specialty pathology conference, two research seminars, CPC and autopsy case review conference. Students will help prepare preliminary and final autopsy reports and will do a clinicopathologic project and present their results to the housestaff and attending faculty. *Dr. Saffitz and Staff*

Selected Topics in Immunology and Immunopathology

This will be a seminar course covering topics in immunology and immunopathology with emphasis both on areas of current research interest in immunology and on areas applicable to the understanding of human disease states. The subject matter can be selected so as to suit student interests but will also include organization of the immune system, immune deficiency and immunosuppression, cellular interaction in the immune response, patterns of immunological disease and diseases with immunological features, tolerance, and autoimmunity. *Dr. T. Braciale*

Cell Biology of the Immune System

This is a seminar course on the biology of lymphocytes and macrophages and their interaction in normal and pathological conditions. Some background in Immunology is desirable. The course places emphasis on current research on how macrophages function in regulating the immune system in normal conditions, in infectious diseases, and in autoimmunity. Students will read and discuss two to three papers per session. *Dr. Unanue and Staff*

Neuropathology

Clinical pathological correlations of neurological diseases will be investigated by the case study method using current and documented material. Participants will partake in gross neuropathological examinations and will be assigned selected cases for discussion of clinical data and gross and microscopic pathological findings, especially in relationship to evolution and mechanism of disease processes. Topics covered will include vascular, infectious, demyelinating, and neuronal diseases, as well as neoplasms of the nervous system. *Dr. Hickey*

Clinical Laboratory Medicine

See Department of Medicine. *Dr. McDonald and Staff*

Anatomic Pathology-Jewish Hospital

This elective is designed to acquaint students who have had some clinical experience with the morphological basis of disease, and to permit them to relearn normal morphological relationships. During the elective students will learn to perform gross autopsy dissections, and will be taught how to select appropriate tissue samples for further microscopic, histochemical, immunofluorescent, and electron microscopy study. Subsequently, they will learn how to perform these procedures under supervision of members of the Anatomic Pathology Staff and how to interpret their results. Following completion of appropriate studies, an in-depth report of clinical pathological correlations will be prepared for each autopsy performed. This elective is considered appropriate for students who intend careers in Internal Medicine, Surgery and Radiology. *Dr. Teitelbaum and Staff*

Laboratory Medicine-Jewish Hospital

Intensive elective training in Laboratory Hematology. Includes training in immunohematology, coagulation and special as well as routine laboratory hematology procedures. Emphasis will be placed on laboratory procedures and their relationship with patient diagnosis and management. *Dr. Teitelbaum*

Surgical Pathology-Jewish Hospital

This elective is designed to acquaint students with the discipline of Surgical Pathology and to permit them to develop basic skills in histopathological inter-

pretation. This elective will be offered to only one student/period in order to permit maximum interaction with the Surgical Pathology Staff and House Officers. During the course of the elective, the student will be taught to function as a junior House Officer. The student will participate in the examination and dissection of gross specimens, take operating room calls, learn frozen section diagnosis, and formulate histopathological diagnoses, all in conjunction with members of the Senior Staff. Since the Laboratory of Surgical Pathology at Jewish Hospital processes a broad range of medical biopsy material as well as specimens derived from busy surgical subspecialty practice, the elective is considered desirable for students who plan careers in internal medicine and surgery as well as for those who intend to enter the field of pathology. *Dr. Crouch*

Surgical Pathology

Surgical pathology offers an elective for a 6-week period under Surgical Pathology I. Students participate fully in activities of the Division of Surgical Pathology and they are responsible for dissection and description of gross specimens and microscopic diagnosis under supervision of the senior staff of the Division. Students attend morning conferences with the Director, surgical and medical grand rounds, tumor and subspecialty conferences. In addition, Surgical Pathology II includes rotations through selected subspecialties: Neuropathology, Hematopathology, Dermatopathology, ENT Pathology, and Gynecologic Pathology. *Drs. Debner, Wick and Staff*

Oncology

The Division of Anatomic Pathology also offers an Oncology course for a 6-week period under the guidance of Walter C. Bauer, M.D. This elective is designed to expose the student to all aspects of neoplastic disease. Students will follow the clinical

course of a variety of cancer patients, correlating clinical response with mode of treatment, state of disease, and pathologic evaluation. Students will make rounds with the medical oncologists and will follow treatment with surgery, irradiation, and chemotherapy. Correlation of the results of radiologic examinations, exfoliative cytology, and tumor kinetic studies with extent of disease and response to treatment will be studied. Students will represent in detail the treatment, rationale for therapy, and observed response on at least one patient per week. *Dr. Bauer*

Obstetrical and Gynecological Surgical Pathology

This 6-week elective offers an intensive experience in Ob-Gyn Pathology involving current surgical material from the Ob-Gyn service. Students will be expected to participate fully in the daily activities in the examination of specimens under the supervision of the senior staff. Slide reviews and conference material will be discussed. Students will attend departmental conferences and the Gyn Tumor Conference. *Dr. Gersell and Staff*

In addition to the above, the department offers several advanced courses in the Division of Biology and Biomedical Sciences. These courses are listed below, but are described in the offerings of the Division of Biology and Biomedical Sciences.

Bio 504. Environmental Pathology

Bio 518, 519. Pathology Research Seminar

Bio 5271, 5272. Topics in Immunology

Note--The number preceding the course title indicates that the course carries credit in the Graduate School of Arts and Sciences.



Faculty

Edward Mallinckrodt
Professor and Head of Department

Emil R. Unanue, M.D., University of Havana, 1960.

Professors Emeriti

Lauren V. Ackerman (Pathology and Surgical Pathology), M.D., University of Rochester, 1932. (Also Consultant)

Ruth Silberberg, M.D., University of Breslau, 1931. (Also Lecturer)

Professors

Jacques U. Baenziger, M.D., Washington University, 1975; Ph.D., 1975.

Walter C. Bauer, M.D., Washington University, 1954.

Thomas J. Braciale, M.D., University of Pennsylvania, 1975; Ph.D., 1975.

Hugh Chaplin, Jr., M.D., Columbia University, 1947. (See Department of Medicine.)

Louis P. Dehner, M.D., Washington University, 1966.

Judith A. Kapp-Pierce, Harvard University, 1976. (See Department of Molecular Microbiology.) (Jewish Hospital)

Gerald Kessler, Ph.D., University of Maryland, 1954. (Jewish Hospital)

John M. Kissane, M.D., Washington University, 1952. (See Department of Pediatrics.)

Michael Kyriakos, M.D., Albert Einstein College of Medicine, 1962.

Robert L. Kroc Professor

Paul E. Lacy, M.D., Ohio State University, 1948; Ph.D., University of Minnesota, 1955.

Jack H. Ladenson, Ph.D., University of Maryland, 1971. (See Department of Medicine.)

Robert W. McDivitt, M.D., Yale Medical School, 1956.

Jay M. McDonald, M.D., Wayne State University, 1969. (See Department of Medicine.)

John W. Olney, M.D., University of Iowa, 1963. (See Department of Psychiatry.)

Carl W. Pierce, M.D., University of Chicago, 1966; Ph.D., 1966. (See Department of Molecular Microbiology.) (Jewish Hospital)

Robert D. Schreiber, Ph.D., State University of New York, 1973. (See Department of Molecular Microbiology.)

Carl H. Smith, M.D., Yale University, 1959. (See Department of Pediatrics.)

Morton E. Smith, M.D., University of Maryland, 1960. (See Department of Ophthalmology and Visual Sciences.)

Wilma and Roswell Messing Professor

Steven L. Teitelbaum, M.D., Washington University, 1964. (Jewish Hospital)

Richard Torack, M.D., Georgetown University, 1952.

Kenneth S. K. Tung, M.B.B.S., Melbourne University, 1959. (See Department of Medicine.)

Mark R. Wick, M.D., University of Wisconsin, 1978.

Joseph R. Williamson, M.D., Washington University, 1958.

Professors

(Visiting Staff)

Frederick T. Kraus, M.D., Washington University, 1955.

John S. Meyer, M.D., Washington University, 1956.

William V. Miller, M.D., University of Missouri, 1966. (See Department of Medicine.)

Laurence A. Sherman, M.D., Albany Medical College, 1964. (See Department of Medicine.)

Associate Professors

Paul M. Allen, Ph.D., University of Michigan, 1981.

Edmond C. Crouch, Ph.D., University of Washington, 1978; M.D., 1979. (Jewish Hospital)

David N. Dietzler, Ph.D., Washington University, 1963. (See Department of Medicine.)

Deborah J. Gersell, M.D., Washington University, 1975.

William F. Hickey, M.D., University of Vermont, 1977.

Donald J. Krogstad, M.D., Harvard Medical School, 1969. (See Department of Medicine.)

Thomas S. Kupper, M.D., Yale University School of Medicine, 1981. (See Department of Medicine.)

Louis G. Lange III, M.D., Ph.D., Harvard University, 1976. (See Department of Medicine.)

Michael L. McDaniel, Ph.D., St. Louis University, 1970.

Daniel W. McKeel, M.D., University of Virginia, 1966.

Joseph P. Miletich, M.D., Washington University, 1979; Ph.D., 1979. (See Department of Medicine.)

Thalachallour Mohanakumar, Ph.D., Duke University, 1974. (See Departments of Medicine and Surgery.)

Patrick R. Murray, Ph.D., University of California, 1974. (See Department of Medicine.)

Moon H. Nahm, M.D., Washington University, 1974. (See Department of Medicine.)

Jeffrey E. Saffitz, Ph.D., Case Western Reserve University, 1977; M.D., 1978.

Samuel A. Santoro, M.D., Vanderbilt University, 1979; Ph.D., 1979. (See Department of Medicine.)

Robert E. Schmidt, M.D., Ph.D., Washington University, 1976.

George F. Schreiner, M.D., Harvard Medical School, 1977; Ph.D., Harvard University, 1977. (See Department of Medicine.)

John W. Turk, M.D., Washington University, 1976; Ph.D., 1976. (See Department of Medicine.)

Associate Professors (Visiting Staff)

Wagih M. Abdel-Bari, M.D., Ein Shams University, 1953; Ph.D., Washington University, 1965.

Daniel J. Santa Cruz, M.D., University of Buenos Aires, 1971.

Assistant Professors

Harry C. Blair, M.D., Washington University, 1980. (Jewish Hospital)

Vivian L. Braciale, Ph.D., University of Pennsylvania, 1973.

Samir K. El-Mofty, Ph.D., Temple University, 1975. (Also School of Dental Medicine)

Thomas A. Ferguson, Ph.D., University of Cincinnati, 1982. (See Department of Ophthalmology and Visual Sciences.)

V. Michael Holers, M.D., Washington University, 1978. (See Department of Medicine.)

Glen L. Hortin, Ph.D., Washington University, 1983; M.D., 1983. (See Department of Pediatrics.)

David L. Lacey, M.D., University of Colorado, 1983. (Jewish Hospital)

Douglas M. Lublin, Ph.D., Stanford University, 1976; M.D., University of California, Los Angeles School of Medicine, 1982. (See Department of Medicine.)

Gwen Mazoujian, M.D., Duke University, 1979.

Jeffrey D. Milbrandt, M.D., Washington University, 1978; Ph.D., University of Virginia, 1983. (See Department of Medicine.)

John C. Morris, M.D., University of Rochester, 1974. (See Department of Neurology and Neurological Surgery.)

Stephen A. Moser, Ph.D., Ohio State University, 1976. (Jewish Hospital)

Kenneth M. Murphy, Ph.D., Johns Hopkins University School of Medicine, 1982; M.D., 1984.



Jay S. Pepose, Ph.D., University of California, Los Angeles, 1980; M.D., 1982. (See Department of Ophthalmology and Visual Sciences.)

Kevin A. Roth, Ph.D., Stanford University School of Medicine, 1985; M.D., 1985.

Matthew L. Thomas, Ph.D., University of Utah, 1981. (See Department of Molecular Microbiology.)

Casey T. Weaver, M.D., University of Florida, 1984.

Research Assistant Professors

Jeffrey P. Lake, Ph.D., Montana State University, 1977. (Jewish Hospital)

Michael L. Landt, Ph.D., University of Oregon, 1976. (See Department of Pediatrics.)

Bratin K. Saha, Ph.D., St. Louis University, 1972.

Craig M. Sorenson, Ph.D., Washington University, 1980. (Jewish Hospital)

Kenneth R. Stone, Ph.D., University of Colorado, 1971.

Ronald G. Tilton, Ph.D., Washington University, 1977.

Research Assistant Professors (Clinical)

Curtis A. Parvin, Ph.D., University of Minnesota, 1980. (See Department of Medicine and Division of Biostatistics.)

Mitchell G. Scott, Ph.D., Washington University, 1982. (See Department of Medicine.)

Victor A. Silva, M.D., St. Louis University, 1971. (See Department of Medicine.)

Assistant Professor (Visiting Staff)

Andres J. Valdes, M.D., University of Havana, 1957.

**Assistant Professor
(Clinical)
(Visiting Staff)**

Parveen Ahmed, M.B.B.S.,
Karachi University, 1970.

Instructors

Michael J. Becich, Ph.D.,
Northwestern University, Chicago,
1984; M.D., 1984.

Elizabeth M. Brunt, M.D.,
University of Texas, 1981.

Rosa Maria Davila, M.D.,
University of Puerto Rico School
of Medicine, 1981. (Jewish
Hospital)

Robert W. Ghiselli, M.D.,
University of Illinois, 1982.

Juan G. Gonzalez, M.D.,
Autonomous University of the
State of Nuevo Leon, 1979.
(Jewish Hospital)

Leonard E. Grosso, M.D.,
University of Wisconsin, 1980;
Ph.D., 1985. (Jewish Hospital)

James O. Palmer, M.D.,
Vanderbilt University, 1981.

Sherrie L. Perkins, Ph.D.,
Washington University, 1984;
M.D., 1985. (Jewish Hospital)

Nancy K. Phillips, M.D., Medical
College of Ohio, 1984.

Mary Anne Rudloff, M.D.,
Washington University, 1979.
(Jewish Hospital)

Valerie S. Schwob, M.D.,
Washington University, 1981.
(Jewish Hospital)

Phyllis E. Whiteley, Ph.D.,
Washington University, 1984.
(Jewish Hospital)

Mary M. Zutter, M.D., Tulane
University School of Medicine,
1981.

Research Instructors

Katherine C. Chang, Ph.D.,
University of Iowa, 1974.

Edward H. Finke, B.S.,
Washington University, 1962.

Instructor (Clinical)

Laurel Krewson, B.S. Carroll
College, 1974. (See Department of
Medicine.)

**Instructors (Visiting
Staff)**

Tomas Aquino, M.D., University
of Havana, 1957; Ph.D., University
of Chicago, 1967.

Antonio Salvador, M.D.,
University of Porto, 1963.

Research Assistants

Shirley B. Carroll, Gradwohl
School of Laboratory Technique,
1955.

Dorothy J. Fiete, B.S.,
Marymount College, 1966.

C. Joan Fink, B.A., Lindenwood
College, 1958.

Connie A. Marshall, B.S.,
Southeast Missouri State
University, 1978.

Santiago Plurad, Ph.D.,
University of Missouri, 1967.

Terecita D. Yule, M.S., University
of New Mexico School of
Medicine, 1979.

EDWARD
MALLINCKRODT
DEPARTMENT OF
PEDIATRICS



PEDIATRICS

The primary aim of the teaching program of the Department of Pediatrics is to stimulate interest in developmental biology, especially human growth and development, and to provide the student with a foundation sufficiently comprehensive so that he or she will have an appreciation of pediatric problems regardless of his or her future career choice in medicine.

The major clinical and research facilities are in St. Louis Children's Hospital, St. Louis Regional Medical Center, and the newborn services at Barnes Hospital and Jewish Hospital. St. Louis Children's Hospital is a new facility with 235 beds and accepts patients through 21 years of age with all types of medical problems. Hospital admittances average 11,000 annually. The Pediatric Ambulatory Division averages about 60,000 visits a year. Nearly 5,000 infants are born annually in the Medical Center.

SECOND YEAR

Students are introduced to pediatrics and to the faculty through a series of lectures and symposia designed to acquaint them with the concepts of human growth and development and the effects of age and maturity on reactions to injury and disease. The unique aspects of the physical examination of the infant and child are presented in the Introduction to Clinical Medicine Course. Members of the faculty are active participants in the Sophomore Pathophysiology Course.

THIRD YEAR

A clerkship of six weeks is scheduled where the student participates in the following:

1. Care of inpatients and outpatients, sharing responsibility with resident physicians.
2. Daily rounds and bedside conferences with house staff and attending physicians.
3. Patient management conferences on basic pediatric problems emphasizing pathophysiologic mechanisms.
4. Weekly grand rounds.
5. Weekly case conference.
6. Weekly professors rounds.
7. Pediatric research conferences.

FOURTH YEAR

This year is devoted to elective time which may be spent according to the individual preferences of the student, who may serve as an intern substitute, in the research laboratory or combine clinical and laboratory work. The following electives are offered:

Allergy and Immunology

(A) Allergy and Clinical Immunology. Inpatient and outpatient clinical experience in the evaluation, diagnosis and treatment of children with a wide spectrum of allergic and immunologic disorders. Clinical and laboratory correlation is emphasized. Elective includes attendance at three weekly Immunology conferences. *Dr. Polmar*

(B) Research.

We are interested in the ways in which pharmacological agents influence immune responses. Studies in the laboratory focus upon the effects of adenosine and other autacoids ("local hormones") influence T-lymphocyte activation. We have found that adenosine acting via specific adenosine receptors can alter lymphocyte activating signals generated by the T-cell receptor complex. The structural, pharmacological and immunological mechanisms involved in this regulatory process are being studied as a basis for the development of a strategy to modulate potentially harmful immune reactions. *Dr. Polmar*

Cardiology

(A) Clinical Elective--Inpatient. The student works as a subintern and is assigned selected patients on the Pediatric Cardiology ward. *Dr. Strauss and Staff*

(B) Clinical Elective--Outpatient. The student will see patients attending all of the outpatient units including both new referrals and follow-up visits. The student will also be responsible for the interpretation of electrocardiograms, echocardiograms, and 24-hour Holter monitor examinations performed in the cardiology non-invasive laboratory. *Dr. Strauss and Staff*

(C) Research.

1. Use of non-invasive imaging techniques (ultrasound, nuclear magnetic resonance) for evaluation and management of congenital heart diseases. *Dr. Canter*

2. Follow-up Studies of Repaired Coarctation of the Aorta. A project to determine incidence of recoarctation especially in the infant group, and the adequacy of repair in older children. Studies will be non-invasive and patients will be evaluated by blood pressure determination at rest as well as during and after an exercise stress test on the bicycle ergometer. Patients will also have studies by magnetic resonance, echocardiography and electrocardiography. *Dr. Goldring*

3. Clinical research includes: Arrhythmias in children, the association of arrhythmias and tumors in tuberous sclerosis, and in the evaluation of children following repair of congenital heart disease. *Dr. Martin*



4. Studies concern the molecular basis of compartmentation of newly synthesized proteins. This research is conducted in the Department of Biochemistry and involves recombinant DNA technology, cloning of various DNA fragments and cell biological techniques. *Dr. Strauss*

Clinical Laboratories

(A) Studies concern the mechanism by which glucose controls insulin secretion. Of particular interest are the roles of calcium-dependent protein kinases in this mechanism. *Dr. Landt*

(B) Studies examine post-translational processing of plasma proteins and molecular interactions between components of the complement and coagulation pathways. Basic questions of molecular recognition and of structure-activity relationships are addressed using methods of protein and peptide chemistry. *Dr. Hortin*

(C) Studies investigate the cellular processes underlying the transport of nutrients by the human placental syncytiotrophoblast. Plasma membranes isolated specifically from the maternal- and fetal-facing surfaces are used to investigate the transport of amino acids and calcium. *Dr. Smith*

(D) Studies dealing with the rapid diagnosis of viral infections. Techniques include immunofluorescence, DNA probes, polymerase chain reaction amplifica-

tion of DNA/RNA and flow cytometry for detection of viral antigens/nucleic acids. *Drs. Storch and Arens*

Endocrinology and Metabolism

(A) Clinical Endocrinology and Metabolism. This elective is designed to include broad clinical experience in pediatric endocrine and metabolic problems. The student has the opportunity to evaluate many pediatric endocrine patients and to see some adult patients during weekly rounds. Emphasis is placed on the practical management of common problems. The student attends rounds and clinics (endocrine, metabolic, and diabetic) and the joint metabolism seminars and rounds held with the medical service. A large number of patients with varied problems are studied in depth during the elective. *Drs. Bier, Santiago and Staff*

(B) Research.

1. Ongoing research in growth disorders includes the study of children with idiopathic and organic hypopituitarism, gonadal dysgenesis, delayed puberty, and short stature of unknown causes. Laboratory research is aimed at identifying variant forms of growth hormone and the somatomedins which may have decreased biological activity and in employing stable isotope tracer techniques to quantify amino acid and protein kinetics in children with growth failure. *Dr. Bier*

2. Studies involve developing and employing insulin infusion devices as well as testing the feasibility of pancreatic islet transplantation in man. Also studied are the mechanisms of normal and abnormal glucose counter-regulation during hyperinsulinemia, and the mechanisms and natural history of diabetic complications. *Dr. Santiago*

3. This laboratory is primarily interested in the study of hepatic glycogen; in particular, the substrate composition of glycogen and the hormonal regulation of its synthesis and degradation. The main technique used is NMR spectroscopy which allows for a dynamic study of these processes *in vivo*. *Dr. Shalwitz*

4. This laboratory is engaged in the development and application of biochemical techniques to study the structure and function of oligosaccharide units on glycoproteins. The laboratory is currently investigating the biosynthesis and glycosylation of insulin and insulin-like growth factor I (IGF 1) receptors. *Dr. Tollefsen*

Gastroenterology

(A) Natural history studies of pediatric gastrointestinal illness including stool holding and soiling and Henoch Schonlein Purpura, x-linked glycogen storage disease, and cystic fibrosis and vitamin deficiency. *Drs. Keating, Rothbaum*

(B) Cellular biochemistry of a genetic defect in transport of alpha-1-antitrypsin through the endoplasmic reticulum; biochemical mechanism for liver and lung injury in alpha-1-antitrypsin deficient individuals; cell specific regulation of alpha-1-antitrypsin gene expression in hepatocytes, enterocytes and macrophages. *Dr. Perlmutter*

(C) Research studies include regulation of the expression of pancreatic acinar cell proteins, especially lipase, colipase, its cofactor, and amylases (both pancreatic and nonpancreatic in origin). Research interests also focus on identifying factors that regulate the metabolism of specific pancreatic proteins following secretion into the pancreatic duct and on developing *in vitro* models for studying regulation of expression of exocrine pancreatic proteins. *Dr. Rosenblum*

General Pediatrics

(A) General Clinical Pediatrics—St. Louis Children's Hospital. The student will be assigned patients on the general pediatric divisions for initial evaluation and continuing care. The student works as an extern and is expected to take night call every third night. Students work directly under the supervision of the senior resident, and teaching rounds are conducted by the faculty. The elective will provide experience in management of many pediatric medical conditions including a wide variety of infectious diseases, failure to thrive, acute asthma, poisoning, immune deficiency diseases, and gastrointestinal disorders. *Dr. Colten and Staff*

(B) Introduction to Primary Pediatric Care. A student will participate in the evaluation of infants, children and adolescents coming to a pediatrician's office. In addition to medical illnesses, the opportunity to do minor surgical procedures, learning appropriate counseling of families with minor or major social problems, becoming acquainted with community services available to families for referral, knowledge of day care centers and problems of the adolescent are all aspects incorporated in this elective. *Drs. Middeldkamp, Nash*

(C) Primary Care in General Pediatrics. This elective is designed to provide the student with firsthand experience in general pediatric practice in a model ambulatory care setting, the Health Key Medical Group. The major component of the elective is direct patient care under the supervision of senior physicians who are members of the group. The objective of this elective is to provide the student with the actual experience of serving as a general pediatrician providing comprehensive health services to the families of a typical, broadly-based population receiving care in an alternate delivery system. Health Key Medical Group is a teaching and research multi-

specialty practice located on the Medical School campus. (Two optional alternate facilities are located in St. Louis County.) *Dr. Simons*

Genetics

(A) Clinical Genetics. Students will be exposed to a broad variety of clinical problems encountered in the Division of Medical Genetics. Patients will be seen during inpatient consultation as well as during Genetics Clinic. Emphasis during this rotation will be placed in several areas: (1) learning physical examination skills appropriate for dysmorphic patients; (2) approaches to patients with hereditary metabolic disorders and families with genetic disease; (3) integration of diagnostic laboratory and radiographic studies with clinical information in genetic diseases. *Dr. Downton and Staff*

(B) Research.

1. Research focuses on: (a) Analysis at the molecular level of the mutations leading to the various forms of x-linked muscular dystrophies with particular emphasis on the Duchenne and Becker types. The initial detection of the mutations and the family analyses are provided by the Molecular Diagnostic Laboratory. (b) Gene mapping of the short arm of the human x-chromosome and particularly of the region surrounding the Ocular Albinism locus. *Dr. de Martinville*

2. Studies include: (a) The molecular regulation of acute phase proteins using the Syrian hamster as a model for amyloidosis. At present we are studying: the structure of the genes; peptide and steroid mediators modulating the synthesis of these proteins; the sites of extrahepatic synthesis; and the fetal response to inflammation. (b) Molecular events in familial malignancy. In this project we are examining DNA isolated from specimens of humans for loss of heterozygosity at a variety of loci using cloned probes. *Dr. Downton*

3. Primary research has involved the study of fragile sites on human chromosomes and, in particular, the fragile X syndrome. These studies have included segregation analyses and the application of linked DNA markers to improve diagnostic accuracy. In-depth studies are done of rare abnormalities which are detected in the Diagnostic Cytogenetic Laboratory. *Dr. Watson*

Hematology and Oncology

(A) Clinical Hematology and Oncology. During this elective students will see a variety of children with hematologic disorders and malignancies. The student will follow patients in the hematology-oncology outpatient unit, work up inpatient consultations, and attend daily hospital rounds on the hematology-

oncology patients. The course also includes formal instruction on interpretation of peripheral blood and bone marrow morphology and teaching rounds and conferences. *Dr. Schwartz and Staff*

(B) Research.

1. Basic cell and molecular biological studies are aimed at elucidation of the structure and function of gap junction proteins. *Dr. Beyer*

2. Studies include: (a) molecular genetic events associated with the development and progression of human neuroblastoma, especially changes in recessive "suppressor" genes and proto-oncogenes; and (b) the role that these genes play in the growth and differentiation of normal neurons. *Dr. Brodeur*

3. Laboratory work focuses on: (a) the molecular basis of antibody diversity and somatic modulation in B cell tumors; (b) clinical trials of active and passive immunotherapy in children with leukemia/lymphoma. *Dr. Carroll*

4. Research interests include the regulation of cell membrane receptor expression during cell growth and specifically the role of phosphorylation in regulating receptor expression and receptor-mediated endocytosis. *Dr. Fallon*

5. (a) Clinical and laboratory studies in the diagnosis and management of children with acute lymphoblastic leukemia (ALL); (b) management of leukemia involving the central nervous system, as well as varicella-zoster prophylaxis in children with ALL. *Dr. Land*

6. Investigative efforts are aimed at the cell biology of cell surface receptors. Using biochemical approaches, we are dissecting the mechanisms responsible for receptor-mediated endocytosis of nutrients and growth factors. *Dr. Schwartz*

7. Dr. Vietti is Chairman of the Pediatric Oncology Group and responsible for the organization and execution of protocol studies at 36 major medical centers plus 24 affiliate institutions in the USA, Canada and Europe and over 700 investigators who care for children with cancer. An additional interest is new agent studies in pediatric cancer. *Dr. Vietti*

8. The interplay of Graft-vs-Host disease and immune recovery are studied post bone marrow transplantation, utilizing recombinant lymphokine technology, as a means of better understanding the cellular interactions that occur in the developing immune system. *Dr. Wall*

9. Research interests include the natural history of sickle cell disease and the rheology of hgb SS containing red cells. Other research concerns characterizing

heritable red cell membrane defects, such as pyropoikilocytosis. *Dr. Zarkowsky*

Infectious Diseases

(A) Clinical Infectious Diseases. This elective is designed to introduce students to the clinical aspects of infectious diseases in children. Students will consult on both inpatients and outpatients. Regular daily activities will include evaluation of new patients, work rounds on inpatient consults, microbiology teaching rounds in the bacteriology lab, and teaching rounds with the infectious disease attending. Students will be expected to take night call from home every third night. Formal teaching sessions include weekly pediatric infectious disease case conferences, a weekly joint clinical conference with the adult infectious disease group, and a weekly journal club. *Dr. Granoff and Staff*

(B) Research.

1. *Haemophilus Influenzae* Otitis Media: Protective Immunity. These studies concern the epidemiology and natural immune response to nontypable *Haemophilus influenzae* otitis in children, and similar studies of the immune response in the chinchilla experimental model of otitis. The goals of this work are to define the important antigenic components of these bacteria which might hold promise as components of future vaccines for the prevention of *Haemophilus* otitis. *Dr. Barenkamp*

2. Molecular Epidemiology of *Haemophilus Influenzae* Type b Infection. The aim of this work is to identify methods for differentiating among strains of type b *Haemophilus*. Characters being examined include outer membrane proteins, alloenzymes, monoclonal



antibody reactivity and DNA polymorphisms. The results will be directly applicable to investigation of outbreaks and transmission of infection caused by this organism. *Drs. Granoff, Munson*

3. Genetic Control of Antibody Responses to Polysaccharide Antigens. This study is designed to examine genetic aspects of susceptibility to *Haemophilus meningitis* and epiglottitis, and IgG subclass responses to polysaccharide vaccines. Studies are underway in normal and immunodeficient populations, as well as on an inbred human (Amish) population. *Dr. Granoff and Staff*

4. Outer Membrane Proteins of *Haemophilus influenzae*. *H. influenzae* type b, a gram-negative bacterium, is the major cause of bacterial meningitis in children under four years of age in the United States. Non-typable *H. influenzae* is an important cause of otitis media in children, and a major cause of lower respiratory disease in children in the developing world. My laboratory is utilizing genetic and immunologic approaches, including molecular cloning and nonoclonal antibody technologies, to understand the role of outer membrane proteins and adhesions of these organisms in the pathogenesis of *Haemophilus* disease, and to determine the role of antibody directed against these surface and antigens in immunity. *Dr. Munson*

5. The Development of the Human B Cell Response to Polysaccharide Antigens. These studies concern the maturation in children of the subclass repertoire and clonal diversity of antibodies produced in response to bacterial polysaccharide (PS) antigens. We are examining V region gene expression using human hybridomas specific for *H. influenzae* type b. *Dr. Shackelford*

6. Strain Variation in Respiratory Syncytial Virus. The goals of this study are to use monoclonal antibodies, electrophoresis of isotopically labeled viral proteins and nucleic acid hybridization probes to detect variation among strains of respiratory syncytial virus. *Dr. Storch*

Nephrology

(A) Clinical Nephrology. This course is designed to provide the student with a wide exposure to all aspects of pediatric renal disease and an opportunity to explore a desired aspect of the field in depth. The student will be an integral part of the Renal Team and as such will see a large number of both inpatients and outpatients. Students will have an opportunity to follow the courses of patients with acute renal disease as well as those with more chronic problems and will help to plan the evaluation and therapeutic management of these patients. Discussions and rounds with the attending staff and fellows emphasize the relationship between clinical

problems and the pathophysiology of the underlying disease. These informal teaching sessions are supplemented by more formal sessions. These include renal attending rounds, renal research rounds, and journal clubs which are conducted weekly in conjunction with the Renal Divisions, Barnes and Jewish Hospitals. Formal conferences are held regularly in association with Dr. John Kissane (renal pathology). Attendance at the weekly pediatric grand rounds and pediatric case conferences is encouraged. Students will be required to present one or two in-depth reviews of areas of interest to them either in renal physiology or clinical topics. *Dr. Cole and Staff*

(B) Research.

1. Major interests of the laboratory are: (a) the study of atrial natriuretic factor conditions of renal failure, cardiac and hypertensive disease and other pathophysiologic states, and (b) the study of the genetic defects in nephrotic syndrome, using molecular biological techniques to study the DNA from children with nephrotic syndrome. *Dr. Cole*

2. The work of this laboratory has three main goals: (a) isolation and structural characterization of human soluble immune response suppressor (SIRS); (b) identification of the events involved in both activation of SIRS production and inhibition of cell function by SIRS; and (c) determination of the role(s) SIRS may play in mediating immunosuppression or other disease states. *Dr. Schnaper*

3. Goals of this research are to understand the signals and mechanisms leading to compensatory adaptation in chronic loss of functioning renal mass (whether experimental surgical or due to chronic disease) and to define the cause of ultimate progression of renal failure under these circumstances. Also, in vitro renal tubular microperfusion is used for studying the tubular transport functions. *Dr. Vebaskari*

Neurology

(A) Clinical Neurology. The student participates as a full member of the neurology service team and is directly responsible for a proportion of the patients on the service under the direction of the senior resident. The student will have the opportunity to take night call every third or fourth night, during which time he/she is responsible for the medical care of the entire unit, as well as for emergency admissions. The student will also see outpatients one day a week, during which time he/she will be able to evaluate outpatient problems. *Dr. Volpe and Staff*

(B) Research.

1. Biochemistry of myelin proteins, with a particular emphasis on post-translational modification. *Dr. Agrawal*

2. NMR spectroscopic studies of developing mammalian brain in the normal animal and in pathological states. *Dr. Deuel*

3. Pharmacokinetics and pharmacodynamic interactions of anticonvulsant drugs. *Dr. Dodson*

4. Biochemistry of cytoskeletal proteins in developing rat brain and spinal cord. *Dr. Noetzel*

5. Mechanisms of neuronal death with oxygen deprivation, with a particular emphasis on excitotoxic amino acids. *Dr. Rothman*

6. Regulation of membrane lipid biosynthesis and glycoprotein biosynthesis in primary cultures of astrocytes, oligodendroglia and neurons. *Dr. Volpe*

Newborn Medicine

(A) Clinical Newborn Medicine. The goal of this course is to provide students with responsibility for caring for newborn infants (who range from normal, to acutely ill, to chronically ill) and their families. The physiology of the transition from fetal to extrauterine existence, the pathophysiology of specific diseases, and primary accountability of the student for patient management decisions and procedures will be emphasized. In addition, collaboration with nursing staff and other health care providers in decision-making (especially concerning the viability of individual infants) and family management will be regularly required.

Two students during each rotation will be assigned to the Special Care Nursery at St. Louis Children's Hospital and one student to the Labor and Delivery Services at Barnes and Jewish Hospitals. Students assigned to the St. Louis Children's Hospital Special Care Nursery will also have the opportunity to become involved in the transport of acutely ill infants, while those on the Labor and Delivery Service will routinely be involved in normal newborn care and delivery room management. The student will be expected to rotate patient responsibilities every third night. *Dr. Cole and Staff*

(B) Research.

1. (a) Lysosomal and nonlysosomal turnover of plasma membrane proteins; (b) mechanisms which regulate turnover and degradation of specific plasma membrane receptors; (c) signals by which proteins are tagged for degradation. *Dr. Bearer*

2. (a) Development and mechanisms of respiratory control and pulmonary mechanics in newborn infants; (b) pathogenesis of bronchopulmonary dysplasia. *Dr. Cohlman*

3. (a) Developmental regulation of complement biosynthesis in mononuclear phagocytes; (b) cellular and molecular basis of genetically determined plasma protein deficiencies; (c) molecular regulatory mechanisms of endotoxin and interferon-gamma. *Dr. Cole*

4. (a) Molecular and cellular biology of copper metabolism during human development; (b) molecular and cellular biology of placental protein transport mechanisms during development. *Dr. Gitlin*

5. The relationship of aberrations of cerebral blood flow to subsequent neuropathology such as intraventricular hemorrhage, hypoxia, ischemic encephalopathy, or periventricular leukomalacia. *Dr. Perlman*

6. Biology of pain in the newborn infant including behavioral, physiological, biochemical, and neurodevelopmental outcome variables. *Dr. Porter*

7. Studies include: (a) mechanical and neural mechanisms in regulation of upper airway patency in infants and in an animal model; and (b) pathophysiology of sleep apnea, apneic episodes, and Sudden Infant Death Syndrome in young infants. *Dr. Thach*

Pulmonary Diseases

(A) The molecular basis for deficiencies of specific proteins involved in inflammation and the effect of these deficiencies on the inflammatory response are ongoing projects. Also being studied: the association between the hyperinflammatory state and progressive pulmonary disease in cystic fibrosis patients. *Dr. Auerbach*

(B) Genetic regulation and ontogeny of the tissue specific expression of complement genes and acute phase proteins as models of inflammation. *Dr. Colten*

(C) The molecular biology of complement deficiencies and structural analysis of the evolution of complement gene families are investigated. *Dr. Wetsel*

(D) (1) Regulation of complement synthesis by mediators of inflammation. Cell and molecular biology techniques are being used to define mechanisms of regulation; and (2) Clinical studies of patients with asthma aimed at understanding the mechanisms of death due to asthma in children. *Dr. Strunk*

(E) The effects of hyperoxic lung injury and inflammation on the metabolism and function of the pulmonary surfactant proteins, and the potential roles of surfactant proteins in lung injury and repair are being studied. *Dr. Noguee*

Faculty

Harriet B. Spoebrer Professor and Head of Department

Harvey R. Colten, M.D., Western Reserve University, 1963; M.A. (hon.), Harvard University, 1978. (See Department of Molecular Microbiology.)

Allen P. and Josephine B. Green Professor of Pediatric Neurology

Arthur L. Prenskey, M.D., New York University, 1955. (See Department of Neurology and Neurological Surgery.)

Alumni Professor of Pediatrics

Alan L. Schwartz, Ph.D., Case Western Reserve University, 1974; M.D., 1976. (See Department of Pharmacology.)

A. Ernest and Jane G. Stein Professor of Developmental Neurology in Pediatrics

Joseph J. Volpe, M.D., Harvard University, 1964. (See Departments of Neurology and Neurological Surgery and Biochemistry and Molecular Biophysics.)

Professors Emeriti

David Goldring, M.D., Washington University, 1940. (Also Lecturer)

Jean H. Thurston, M.D., University of Alberta, 1941. (See Department of Neurology and Neurological Surgery.)

Professors

Harish C. Agrawal, Ph.D., Allahabad University, 1964. (See Department of Neurology and Neurological Surgery.)

Dennis M. Bier, M.D., New Jersey College of Medicine, 1966. (See Department of Medicine.)

Ruthmary K. Deuel, M.D., Columbia University College of Physicians and Surgeons, 1961. (See Department of Neurology and Neurological Surgery.)

Philip R. Dodge, M.D., University of Rochester, 1948. (See Department of Neurology and Neurological Surgery.)

W. Edwin Dodson, M.D., Duke University, 1967. (See Department of Neurology and Neurological Surgery.)

Dan M. Granoff, M.D., Johns Hopkins University, 1968. (See Department of Molecular Microbiology.)

Alexis F. Hartmann, Jr., M.D., Washington University, 1951.

John C. Herweg, M.D., Washington University, 1945. (See Administration.)

Lawrence I. Kahn (Health Care Research), M.D., Louisiana State University, 1945. (See Health Administration.)

James P. Keating, M.D., Harvard University, 1963.

John M. Kissane, M.D., Washington University, 1952. (See Department of Pathology.)

William H. McAlister, M.D., Wayne State University, 1954. (See Department of Radiology.)

J. Neal Middelkamp, M.D., Washington University, 1948.

Stephen H. Polmar, Ph.D., Case Western Reserve University, 1966; M.D., 1967. (See Department of Molecular Microbiology.)

Julio V. Santiago, M.D., University of Puerto Rico, 1967. (See Department of Medicine.)

Gary D. Shackelford, M.D., Washington University, 1968. (See Department of Radiology.)

Carl H. Smith, M.D., Yale University, 1959. (See Department of Pathology.)

Arnold W. Strauss, M.D., Washington University, 1970. (See Department of Biochemistry and Molecular Biophysics.)

Robert C. Strunk, M.D., Northwestern University, 1968.

Jessie L. Ternberg, Ph.D., University of Texas, 1950; M.D., Washington University, 1953; Sc.D. (hon.), Grinnell College, 1972. (See Department of Surgery.)

Bradley T. Thach, M.D., Washington University, 1968.

Teresa J. Vietti, M.D., Baylor University, 1953. (See Department of Radiology.)

Professors (Clinical)

Maurice J. Keller, M.D., Columbia University, 1940.

Maurice J. Lonsway, M.D., Washington University, 1950.

James E. Miller, M.D., Medical College of Alabama, 1949. (See Department of Ophthalmology and Visual Sciences.)

Helen E. Nash, M.D., Meharry Medical College, 1945.

George Sato, M.D., Washington University, 1947.

Argyrios A. Tsifutis, M.D., Aristotelion University of Thessalonika, 1954.

Associate Professor Emeritus

Dorothy J. Jones, M.D., Washington University, 1934.

Associate Professors

Garrett M. Brodeur, M.D., Washington University, 1975. (See Department of Genetics.)

Barbara R. Cole, M.D., University of Kansas, 1967.

F. Sessions Cole, M.D., Yale University, 1973. (See Department of Cell Biology and Physiology.)

Felton J. Earls, M.D., Howard University, 1967. (See Department of Psychiatry.)

Vita J. Land, M.D., McGill University, 1965.

Charles B. Manley, Jr. (Genitourinary Surgery), M.D., University of Missouri, 1958. (See Department of Surgery.)

Jeffrey L. Marsh, M.D., Johns Hopkins University, 1970. (See Department of Surgery.)

Robert S. Munson, Ph.D., University of Connecticut, 1976. (See Department of Molecular Microbiology.)



David H. Perlmutter, M.D., St. Louis University, 1978. (See Department of Cell Biology and Physiology.)

Steven M. Rothman, M.D., State University of New York, Upstate, 1973. (See Departments of Anatomy and Neurobiology and Neurology and Neurological Surgery.)

Penelope G. Shackelford, M.D., Washington University, 1968. (See Department of Molecular Microbiology.)

Marilyn J. Siegel, M.D., State University of New York, Downstate, 1969. (See Department of Radiology.)

Paul S. Simons, M.D., Washington University, 1967. (See Health Key Medical Group.)

James K. Turner, M.D., Washington University, 1953. (See Health Key Medical Group.)

Michael P. Whyte, M.D., State University of New York, Downstate, 1972. (See Department of Medicine.)

Harold S. Zarkowsky, M.D., Washington University, 1961.

Research Associate Professor

Thomas L. Vogel (Psychology), Psy.D., Illinois School of Professional Psychology, 1981.

Associate Professors Emeriti (Clinical)

Helen M. Aff, M.D., Washington University, 1934.

Max Deutch, M.D., Washington University, 1926.

Stanley L. Harrison, M.D., Washington University, 1930.

Frederick A. Jacobs, M.D., Washington University, 1928.

Sol Londe, M.D., Washington University, 1927.

Frank S. Wissmath, M.D., Washington University, 1943.

Associate Professors (Clinical)

Gordon R. Bloomberg, M.D., University of Illinois, 1959.

C. Read Boles, M.D., Washington University, 1943.

James M. Corry, M.D., Washington University, 1974.

Robert H. Friedman, M.D., Washington University, 1948.

Elliot F. Gellman, M.D., University of Missouri, 1961.

Gene H. Grabau, M.D., Washington University, 1942.

Marshall B. Greenman, M.D., University of Illinois, 1948.

Kenneth A. Koerner, M.D., Washington University, 1941.

John C. Martz, M.D., Washington University, 1942.

Homer E. Nash, Jr., M.D., Meharry Medical College, 1951.

Frederick D. Peterson, M.D., Washington University, 1957.

Steven I. Plax, M.D., University of Missouri, 1961.

Warren G. Sherman, M.D., Tulane University, 1969.

Assistant Professors

Harvey S. Auerbach, M.D., Autonomous University of Guadalajara, 1976.

Stephen J. Barenkamp, M.D., University of Chicago, 1977.

Eric C. Beyer, Ph.D., University of California, 1981; M.D., 1982.

Richard J. Bower, M.D., University of Virginia, 1969. (See Department of Surgery.)

William L. Carroll, M.D., University of California, 1978.

Kathryn Lynn Cates, M.D., Northwestern University, 1973. (See Department of Genetics.)

Fred C. Chu, M.D., Cornell University, 1971. (See Department of Ophthalmology and Visual Sciences.)

Berengere M. de Martinville, M.D., Lyon Medical School, 1973.
(See Department of Genetics.)

S. Bruce Dowton, B.M., B.S., University of New South Wales, 1980. (See Department of Genetics.)

Robert J. Fallon, M.D., New York University, 1980; Ph.D., 1980.

Jonathan D. Gitlin, M.D., University of Pittsburgh, 1978.

Glen L. Hortin, Ph.D., Washington University, 1983; M.D., 1983.

Rodney P. Lusk, M.D., University of Missouri, Columbia, 1977. (See Department of Otolaryngology.)

Thomas C. Martin, M.D., University of Michigan, 1976.

Harlan R. Muntz, M.D., Washington University, 1977. (See Department of Otolaryngology.)

Michael J. Noetzel, M.D., University of Virginia, 1977. (See Department of Neurology and Neurological Surgery.)

Jeffrey M. Perlman, M.B., Ch.B., University of Cape Town, 1974.

Mabel L. Purkerson, M.D., Medical College of South Carolina, 1956. (See Administration and Department of Medicine.)

Jerry L. Rosenblum, M.D., Washington University, 1974.

Robert J. Rothbaum, M.D., University of Chicago, 1976.

H. William Schnaper, M.D., University of Maryland, 1975.

Robert A. Shalwitz, M.D., State University of New York, Buffalo, 1980.

Gregory A. Storch, M.D., New York University School of Medicine, 1973. (See Department of Medicine.)

Sherida E. Tollefsen, M.D., Washington University, 1975.

V. Matti Vehaskari, M.D., Helsinki University, 1970.

Abby L. Wasserman, M.D., Johns Hopkins University, 1970. (See Department of Psychiatry.)

Michael S. Watson, Ph.D., University of Alabama, 1981. (See Department of Genetics.)

Zila Welner, M.D., Hebrew University, 1961. (See Department of Psychiatry.)

Rick A. Wetsel, Ph.D., University of Texas, San Antonio, 1982. (See Department of Molecular Microbiology.)

Research Assistant Professors

Peter A. Ambrose, Jr. (Psychology), Ph.D., University of Missouri, 1987.

Max Q. Arens, Ph.D., Virginia Polytechnic Institute and State University, 1971.

Ronald L. Gingerich, Ph.D., Indiana University, 1975. (See Department of Medicine.)

Michael L. Landt (Laboratory Medicine), Ph.D., University of Oregon, 1976. (See Department of Pathology.)

Joseph P. Marnett (Psychology), Ph.D., Southern Illinois University, 1985.

Assistant Professors Emeriti (Clinical)

Martin Calodney, M.D., New York University, 1936.

Samuel W. Gollub, M.D., Washington University, 1941.

Edith C. Robinson, M.D., Johns Hopkins University, 1932.

Alfred S. Schwartz, M.D., Johns Hopkins University, 1936.

Assistant Professors (Clinical)

Jill M. Baer, M.D., University of Kentucky, 1975.

Edward T. Barker, M.D., Washington University, 1957.

Walter F. Benoist, M.D., Washington University, 1972.

Max H. Burgdorf, M.D., Washington University, 1974.

Garrett C. Burris, M.D., Louisiana State University, 1968. (See Department of Neurology and Neurological Surgery.)

Charles E. Canter, M.D., St. Louis University, 1979.

John C. Davis, M.D., University of Michigan, 1980.

Sandra J. Dodson, M.D., Northwestern University, 1976.

Charles H. Dougherty, M.D., University of Rochester, 1973.

Gerald J. Duling, M.D., St. Louis University, 1959.

Ira J. Friedman, M.D., University of Arkansas, 1960.

Tessa D. Gardner, M.D., Harvard University, 1972.

James A. Gerst, M.D., University of Missouri, 1972.

James W. Grant, M.D., Duke University, 1979.

Santosh Gupta, M.B.B.S., Lucknow University, 1963; D.C.H., University of London, 1966.

J. Larry Harwell, M.D., University of Missouri, 1961.

Robert J. Hoffman, M.D., St. Louis University, 1976.

Henry L. Knock, M.D., Johns Hopkins University, 1953.

Richard L. Lazaroff, M.D., St. Louis University, 1978.

Stanley B. Lyss, M.D., Washington University, 1962.

Thomas C. McKinney, M.D., Washington University, 1980.

M. Michael Maurer, M.D., Washington University, 1972.

Kevin J. Murphy, M.D., St. Louis University, 1978.

Paul H. Painter, M.D., St. Louis University, 1947. (See Division of Child Psychiatry.)

Susan Pittman, M.D., University of Missouri, 1963.

James R. Rohrbaugh, M.D., Ohio State University, 1974. (See Department of Neurology and Neurological Surgery.)

William J. Ross, M.D., Washington University, 1972.

Richard W. Sato, M.D., Washington University, 1977.

Mary A.T. Tillman, M.D., Howard University, 1960.

George T. Wilkins, Jr., M.D., University of Illinois, 1957.

Kathleen Winters, M.D., Medical College of South Carolina, 1955.

Patricia B. Wolff, M.D., University of Minnesota, 1972. (See Health Key Medical Group.)

Gerald Wool, M.D., Washington University, 1962.

Instructors

Denis I. Altman, M.B., B.Ch., University of Witwatersrand, 1975. (See Department of Neurology and Neurological Surgery.)

Cynthia F. Bearer, Ph.D., Case Western Reserve University, 1977; M.D., Johns Hopkins University, 1982.

Douglas W. Carlson, M.D., Southern Illinois University, 1984.

Susan L. Church, M.D., McGill University, 1982.

Antonella Circolo, M.D., University of Perugia, 1978.

Barbara A. Cohlman, M.D., New York University, 1978.

Michael T. Connor, M.D., Wayne State University, 1974. (See Department of Anesthesiology.)

Jeffrey G. Dawson, M.D., University of Louisville, 1982.

Anna M. Fitz-James, M.D., George Washington University, 1981.

William M. Gershan, M.D., Medical College of Wisconsin, 1983.

Joel B. Gunter, M.D., University of Oklahoma, 1982. (See Department of Anesthesiology.)

Donald V. Huebener (Dental Medicine), D.D.S., Washington University, 1969. (See Department of Radiology.)

Robert M. Kennedy, M.D., Medical College of Georgia, 1980.

Joel S. Koenig, M.D., Vanderbilt University, 1982.

Nancy A. Lass, M.D., Chicago Medical School, 1981.

Mark E. Lowe, M.D., University of Miami, 1984.

Janet B. McGill, M.D., Michigan State University, 1979; M.A., Northern Michigan University, 1980.

Anne M. Murphy, M.D., Johns Hopkins University, 1981.

Lawrence M. Noguee, M.D., Johns Hopkins University, 1981.

Patricia A. Parsons (Dental Medicine), D.D.S., Washington University, 1957.

Scott L. Pomeroy, Ph.D., University of Cincinnati, 1980; M.D., 1982. (See Department of Neurology and Neurological Surgery.)

Fran L. Porter, Ph.D., Washington University, 1977.

Nancy S. Rader, M.D., University of Missouri, 1985.

Robert S. Rust, Jr., M.D., University of Virginia, 1981. (See Department of Neurology and Neurological Surgery.)

Monica H. Ultmann, M.D., Columbia University College of Physicians and Surgeons, 1980.

Donna A. Wall, M.D., University of Manitoba, 1981.

Mehernoor F. Watcha, M.D., University of Bombay, 1973. (See Department of Anesthesiology.)

B. Craig Weldon, M.D., St. Louis University, 1978. (See Department of Anesthesiology.)

Research Instructors

Janet M. Dubinsky, Ph.D., University of North Carolina, 1983.

Michael J. Engle, Ph.D., St. Louis University, 1976.

Carla R. Fjeld, Ph.D., University of Chicago, 1987.

Instructor Emeritus (Clinical)

Joseph A. Bauer, M.D., Washington University, 1926.

Instructors (Clinical)

Patricia J. Amato, M.D., Medical College of Ohio, 1982.

Christos A. Antoniou, M.D., University of Athens, 1958.

Jean M. Auguste, M.D., Medical School of Haiti, 1956.

Bonnie J. Aust, M.D., University of Texas, San Antonio, 1979.

Susan L. Baumer, M.D., University of Pennsylvania, 1975.

Miriam J. Behar, M.D., Johns Hopkins University, 1981.

Robert A. Bergamini, M.D., Albany Medical College, 1978.

Huldah C. Blamoville, M.D., Meharry Medical College, 1965.

Eyla G. Boies, M.D., Washington University, 1978.

Tattamangalam P. Chandrika, M.S.B.S., Calicut Medical College, 1973.

Sarah J. Corriveau, M.D., Medical College of Wisconsin, 1979.

Ray S. Davis, M.D., University of Louisville, 1978.

Edward B. Fliesher, M.D., St. Louis University, 1978.

Terrel L. French, M.D., Creighton University, 1983.

Florentina U. Garcia, M.D., University of the Philippines, 1965.

Melanie K. Gilliam, M.D., University of Louisville, 1981.

Joseph K. Goldenberg, M.D., University of Missouri, Kansas City, 1980.

Roman E. Hammes, M.D., University of Iowa, 1954.

Timothy P. Hickman, M.D., University of Missouri, 1980.

Nancy E. Holmes, M.D., University of Missouri, 1976.

Carl S. Ingber, M.D., Boston University, 1972.

Aidan W. Ip, M.D., University of Chicago, 1979.

Joyce D. Johnson, M.D., Case Western Reserve University, 1982.

William L. Johnson, M.D., University of Missouri, Columbia, 1981.

Larry A. Jones, M.D., Johns Hopkins University, 1976.

Joseph A. Kahn, M.D., University of Missouri, Columbia, 1977.

Michele E. Kemp, M.D., Washington University, 1981.

Sheldon Kessler, M.D., St. Louis University, 1951.

Shirley M. Knight, M.D.,
Washington University, 1980.

Robert L. Korn, M.D.,
Washington University, 1949.

Katherine L. Kreusser, M.D.,
Indiana University, 1978.

Norton S. Kronemer, M.D.,
University of Missouri, 1962.

Michael P. Kucera, M.D., St.
Louis University, 1982.

Leland M. Laycob, M.D.,
University of Missouri, 1968.

Barry Light, Ph.D., University of
Missouri, Columbia, 1977; M.D.,
1980.

Robert D. Lins, M.D., University
of Missouri, 1969.

John F. Mantovani, M.D.,
University of Missouri, 1974. (See
Department of Neurology and
Neurological Surgery.)

Elaine Miller, M.D., Medical
College of Alabama, 1949.

Susan J. Nelson, M.D.,
Washington University, 1978.

Laura L. Norling, M.D., Ohio
State University, 1978.

David S. Olander, Ph.D.,
Washington University, 1967;
M.D., 1974.

Eugenia M. Pierce, M.D.,
St. Louis University, 1958.

Juanita C. Polito, M.D.,
Southwestern University, 1979.

Joseph L. Portnoy, M.D.,
University of Kansas, 1974.

Robert L. Quaas, M.D., University
of Chicago, 1975.

Mohammad H. Rahman,
M.B.B.S., University of Karachi,
1960.

Jesse R. Ramsey, D.O., Texas
College of Osteopathic Medicine,
1974.

Martin D. Rudloff, M.D.,
Washington University, 1981.

Janet M. Ruzycski, M.D.,
Washington University, 1981.

Howard J. Schlansky, M.D.,
University of Missouri, Kansas City,
1978.

Seymour M. Schlansky, M.D.,
Chicago Medical School, 1950.

Pamela M. Schuler, M.D.,
University of Michigan, 1979.

Jeffrey I. Schulman, M.D.,
University of Kentucky, 1974.

Norman P. Steele, M.D., Indiana
University, Indianapolis, 1972.

Robert H. Strashun, M.D.,
New York University, 1982.

Orestes S. Valdes, M.D.,
University of Havana, 1954.

Barbara N. Voegel, M.D.,
Washington University, 1957.

Roger J. Waxelman, M.D.,
University of Missouri, 1969.

Marc E. Weber, M.D., University
of Tennessee, 1974; J.D., St. Louis
University, 1982.

Jeffrey M. Wright, M.D.,
Washington University, 1979.

H. Benjamin Zwirn, M.D.,
University of Basel, 1954.

Research Associates

Charles E. Crawford, Jr., M.S.,
Lindenwood College, 1983.

Richard E. Hauhart, M.S.,
University of Missouri, St. Louis,
1982.

Margaret S. Jacobi, M.B., Ch.B.,
University of Birmingham, 1982.

Aaron J. Moe, Ph.D., Virginia
Polytechnic Institute and State
University, 1984.

Charles A. Reed, A.B.,
Washington University, 1961.

Assistant

Mary Jo Stralka (Health
Services), B.S.N., St. Louis Univer-
sity, 1970; P.N.P., 1971; M.S.N.,
1978. (See Health Key Medical
Group.)

Assistants (Clinical)

Nalini Amin, M.B., B.S. NHL MUN
Medical College, 1985.

Juli A. Antonow, M.D., University
of Minnesota, 1975.

Eleanor M. Bedwell, M.D.,
University of Missouri, 1983.

Earl C. Beeks, Jr., M.D.,
University of Missouri, Columbia,
1981.

Marietta O. Belen, M.D.,
Far Eastern University, 1963.

Michele R. Berman, M.D.,
Washington University, 1981.

Earline A. Brownridge, M.D.,
University of Missouri, Columbia,
1982.

Seth J. Brownridge, M.D.,
Washington University, 1982.

William T. Chao, M.D.,
University of Illinois, Chicago,
1979.

Darryl S. Cohen, D.O., Texas
College of Osteopathic Medicine,
1981.

Linda M. Harris, M.D., Tulane
University, 1983.

Deborah A. Herbst, M.D.,
St. Louis University, 1981.

Shirin Jadidi, M.D., University of
Iowa, 1983.

Denise R. Johnson, M.D., Loma
Linda University, 1984.

James M. Krafchik, M.D.,
Vanderbilt University, 1983.

Jerome H. O'Neil, Jr., M.D.,
St. Louis University, 1981.

Irma I. Ortiz-Arroyo, M.D.,
University of Puerto Rico, 1985.

Martha A. Papay, M.D.,
University of Missouri, 1985.

Habibur Rahman, M.B.B.S.,
Dacca University Medical College,
1972.

Karen L. Remley, M.D.,
University of Missouri, Kansas
City, 1980.

Catherine R. Remus, M.D., Rush
University, 1983.

Isabel Rosenbloom, M.D.,
University of Maryland, 1984.

Hsin-Chin Shih, M.D.,
Kaoshiung Medical College, 1964.

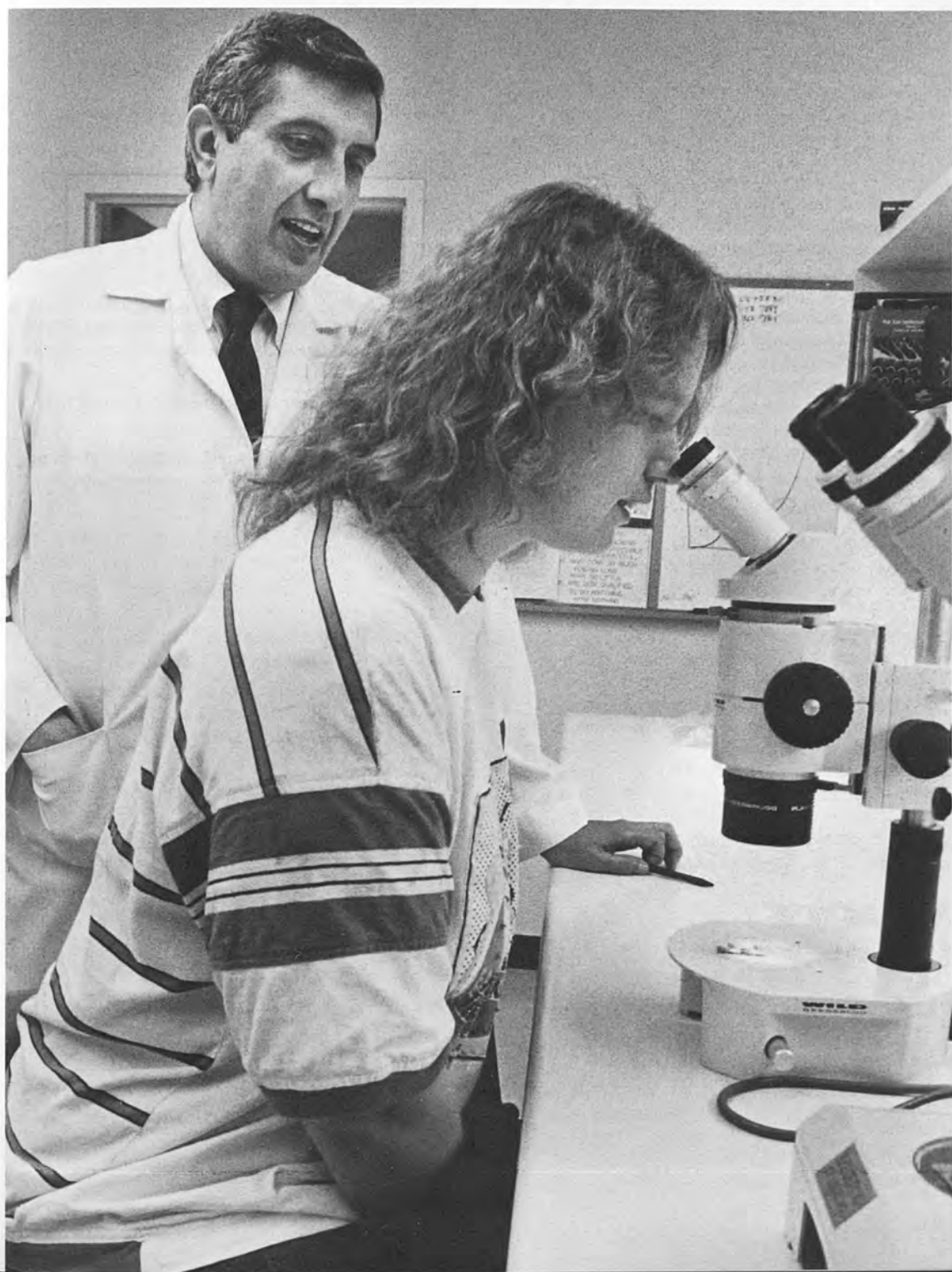
Joan L. Snipes, M.D., University
of Missouri, Kansas City, 1982.

Nareshkumar Solanki, B.M.,
B.S., University of Nairobi, 1975.

Robert D. Spewak, M.D.,
St. Louis University, 1979.

Garland R. Tschudin, M.D.,
University of Missouri, Columbia,
1975.

EDWARD
MALLINCKRODT
DEPARTMENT OF
PHARMACOLOGY



PHARMACOLOGY

The Pharmacology Department has been influenced by the historical interdisciplinary position of both pharmacology itself and this department in particular. It is no accident that the research interests of individual laboratories span a broad range of scientific disciplines. Pharmacology serves as the focal point for the application of various scientific specialties to specific issues of clinical or basic biological interest. This amalgam of views is achieved through several weekly meetings in which research from individual laboratories or recent papers in the literature are discussed by everyone in an informal setting. Students in the Pharmacology training program as well as staff and postdoctoral fellows are expected to participate in these discussions and present both their own research and critical evaluations of recent work in the literature.

The interdisciplinary nature of the training program draws not only on the heterogeneous interests from within the department, but also from the rich diversity of interests of the more than 200 laboratories from within the University. Thus the training grants have primary investigators from ten different departments in addition to members of the Pharmacology Department itself.

Students in Pharmacology are expected to demonstrate a breadth of understanding of basic chemical, biochemical, physiological processes from the molecular through the cellular and organismal levels of organization. This is normally accomplished through formal coursework, although alternative methods can be arranged depending on the individual circumstances. During the 1½ to 2 year period of formal coursework, students are expected to participate in research projects of two-three different laboratories. Thus, within 2½ to 3 years of entering the program, students should submit a proposed course of research the completion of which would constitute an acceptable thesis. Acceptance of the research proposal is normally followed by two-three years of experimental work leading to the thesis defense. The student's progress during these experimental years is monitored by the thesis committee. The normal length of time required to complete a Ph.D. degree is 4½ to 5 years.

SECOND YEAR

Bio 507, 508. Pharmacology

It is the purpose of the pharmacology course, through discussions of existing drugs, to develop general principles which will be applicable as well to drugs of the future. Pharmacology draws heavily on biochemistry, physiology, and microbiology for an understanding of drug action. It looks toward pathology, medicine, and surgery for its uses.

The laboratory portion of the course is closely coordinated with the lecture material and is designed to demonstrate and emphasize pertinent pharmacological principles and employ agents, equipment, and skills relevant to current medical practice.

A selection of mini-courses (Special Topics), dealing in depth with more advanced concepts of pharmacology and related topics, is integrated into the medical pharmacology course. Small groups of students regularly meet with the faculty to review and discuss the details and interpretation of original literature articles.

(a) Lectures, conferences, panel discussions.

(b) Laboratory course.

Credit 7 units for the year. *Dr. Covey and Staff*

RESEARCH

Bio 590.

The facilities of the research laboratories are available to those who wish to carry on an original investigation on problems of their own or on those the department is prepared to suggest.

Pharmacology of cardiovascular diseases, especially hypertension; endocrinology of water and electrolyte homeostasis. *Dr. Blaine*

Expression of placental and pituitary peptide hormone genes. *Dr. Boime*

Experimental analysis of mechanisms of arrhythmia; electrophysiology; membrane chemistry, and autonomic neural effects. *Dr. Corr*

Preparation and biochemical characterization of mechanism-based inhibitors of steroid biosynthesis; development of anticonvulsant drugs. *Dr. Covey*

The molecular mechanism of volatile anesthetic action studied both biochemically and by NMR spectroscopy. *Dr. Evers*

Neurochemistry of seizures; neuropharmacology of anticonvulsant and neurotropic drugs; functional neuroanatomy of experimental generalized seizures. *Dr. Ferrendelli*

Biosynthesis, secretion, and metabolism of atrial natriuretic peptides. *Dr. Geller*

Molecular regulation of phospholipases involved in signal transduction. *Dr. Gross*

The biosynthesis and chemical and biological characterization of leukotrienes and other arachidonate metabolites. *Dr. Jakschik*

Biology of nerve growth factor; neural development and regulation; mechanism(s) of cell death. *Dr. Johnson*

Mechanism of insulin action; neural control of skeletal muscle enzymes. *Dr. Laurence*

Role of lipid mediators and polyunsaturated fatty acids in inflammation and organ immunogenicity. *Dr. Lefkowitz*

Neurochemistry; regulation of metabolism; quantitative histochemistry; the chemistry of individual human muscle fibers; metabolism of human ova.

Dr. Lowry

Molecular biology of the development and maintenance of the nervous system. *Dr. Manning*

Molecular basis of recognition of drugs using NMR, analog synthesis, and computer modeling.

Dr. Marshall

Metabolic "reflections" of neuronal activity among brain regions in response to various perturbations.

Dr. McDougal

Synthesis, assembly, and function of synaptic proteins. *Dr. Merlie*

Role of membrane lipids in renal epithelial cell function. *Dr. Morrison*

Identification and pharmacological manipulation of intrinsic mediators. *Dr. Needleman*

Regulation and modulation of ion channels by intracellular "second" messengers; design and characterization of photolabile intracellular probes.

Dr. Nerbonne

Study of eicosanoid metabolism of keratinocytes and fibroblasts in normal and diseased skin.

Dr. Pentland

Biology of cytotoxic lymphocytes and mechanisms of immune damage. *Dr. Russell*

Receptor cell biology: intracellular pathways of ligands and receptors. *Dr. Schwartz*

ELECTIVES

Descriptions of the following courses are shown in the Division of Biology and Biomedical Sciences:

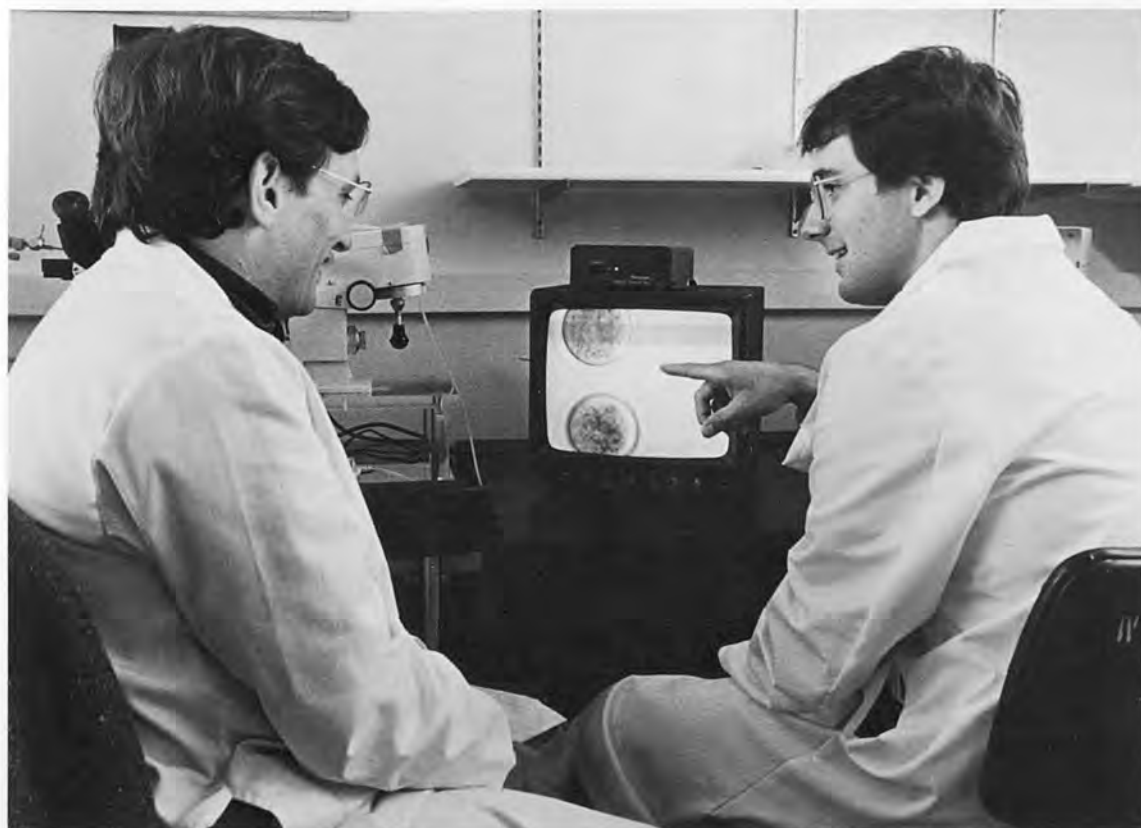
Bio 509, 510. Current Topics in Pharmacology

Bio 5291. Intracellular Mediators and Regulation of Cellular Function

Bio 5402. Molecular Biology of Transmitters and Receptors

Bio 5461. Molecular Recognition

Note--The number preceding the course title indicates that the course carries credit in the Graduate School of Arts and Sciences.



Faculty

Distinguished Professor Emeritus and Acting Head of Department

Oliver H. Lowry, Ph.D., University of Chicago, 1937; M.D., 1937.

Professor Emeritus

F. Edmund Hunter, Jr., Ph.D., University of Rochester, 1941.

Professors

Irving Boime, Ph.D., Washington University, 1970. (See Department of Obstetrics and Gynecology.)

James A. Ferrendelli, M.D., University of Colorado, 1962. (See Departments of Neurology and Neurological Surgery and Ophthalmology and Visual Sciences.)

Eugene M. Johnson, Jr., Ph.D., University of Maryland, 1970.

David B. McDougal, Jr., M.D., University of Chicago, 1947.

Garland R. Marshall, Ph.D., Rockefeller University, 1966. (See Department of Biochemistry and Molecular Biophysics.)

John P. Merlie, Ph.D., University of Pennsylvania, 1973.

Aubrey R. Morrison (Burroughs Wellcome Clinical Pharmacology Scholar), M.B., B.S., University of London, 1970. (See Department of Medicine.)

Alan L. Schwartz, Ph.D., Case Western Reserve, 1974; M.D., 1976. (See Department of Pediatrics.)

Research Professor

Philip Needleman, Ph.D., University of Maryland, 1964.

Associate Professors

Peter B. Corr, Ph.D., Georgetown University, 1975. (See Department of Medicine.)

Douglas F. Covey, Ph.D., Johns Hopkins University, 1973.

David M. Geller, Ph.D., Harvard University, 1957.

Richard W. Gross, M.D., New York University, 1976; Ph.D., Washington University, 1982. (See Department of Medicine.)

John C. Lawrence, Jr., Ph.D., University of Virginia, 1978.

John H. Russell, Ph.D., Washington University, 1974.

Research Associate Professor

Sr. Barbara A. Jakschik, Ph.D., Washington University, 1974.

Assistant Professors

Alex S. Evers, M.D., New York University, 1978. (See Department of Anesthesiology.)

James B. Lefkowitz, M.D., Johns Hopkins University, 1979. (See Department of Medicine.)

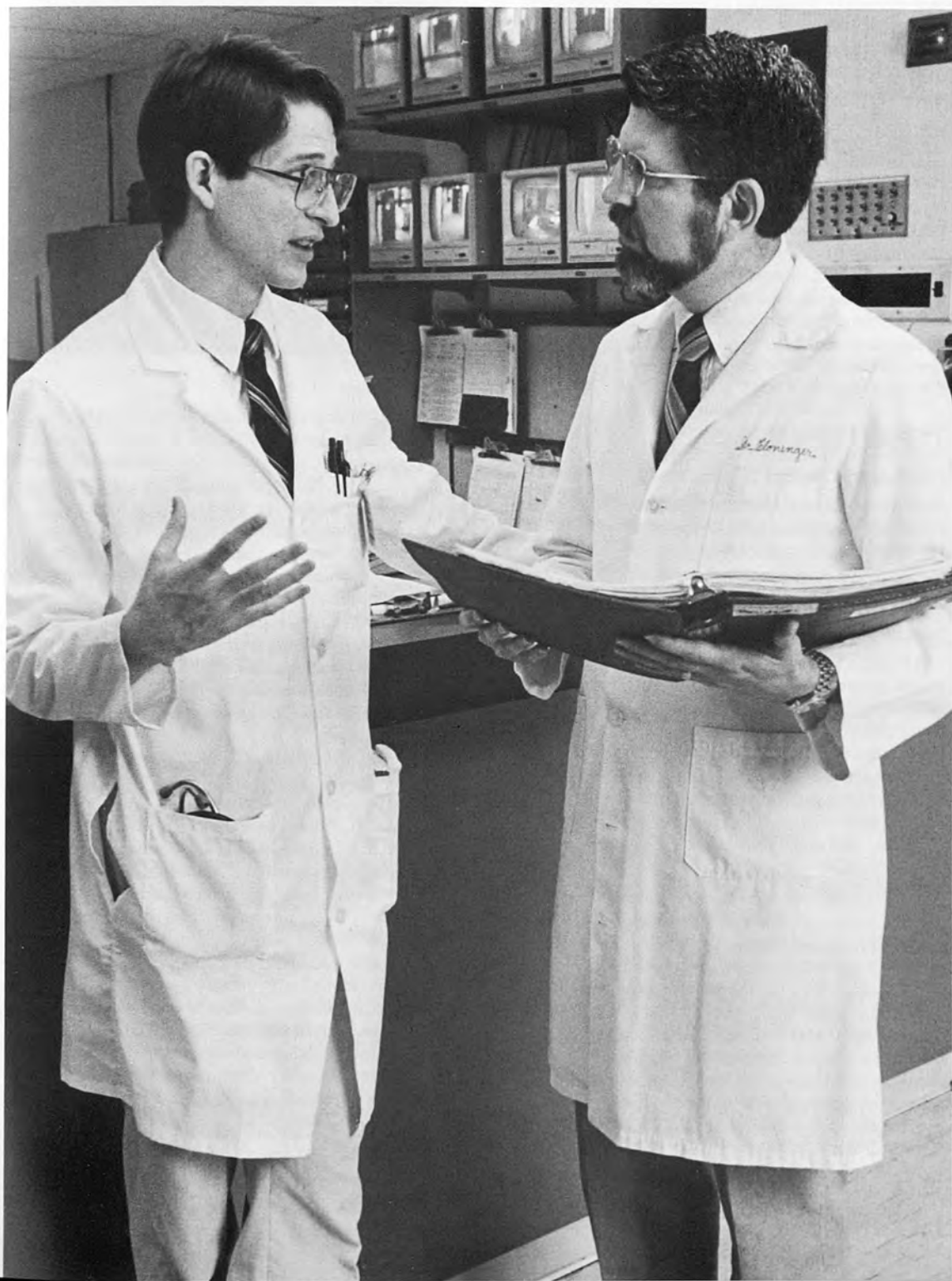
Jeanne M. Nerbonne, Ph.D., Georgetown University, 1978.

Adjunct Assistant Professors

Edward H. Blaine, Ph.D., University of Missouri, Columbia, 1970.

Pamela T. Manning, Ph.D., Ohio State University, 1980.

**DEPARTMENT OF
PSYCHIATRY**



PSYCHIATRY

Instruction in psychiatry is given in the last three years of the medical course. Emphasis is on teaching psychiatry as a medical discipline, including the biological, social, and psychological mechanisms and manifestations of psychiatric illness, as well as psychological reactions to other illnesses. Recognition of current limitations of knowledge combined with an appreciation of what is known leads to a spirit of constructive skepticism. This attitude permits the student to study psychiatry in depth and broadly without preconceived theories.

SECOND YEAR

Introduction to Clinical Psychiatry

Emphasis is upon (a) effective interviewing in preparation for medical history taking, (b) evaluation of behavioral and emotional factors in patients with various kinds of illnesses, (c) the diagnosis and natural history of the major psychiatric disorders, (d) critical evaluation of conceptual and methodologic problems in psychiatry and psychology. Lectures, demonstration interviews, discussions.

Dr. Cloninger and Staff

THIRD YEAR

Psychiatry Clerkship

Students in groups of about 15 spend six weeks on the inpatient services of Barnes, Jewish, and Bliss Hospitals. *Dr. Early and Staff*

FOURTH YEAR

"A" Electives

(A) Human Sexuality. Human sexuality is a 19-hour practical introduction to human sexual function and dysfunction encountered in practice. Lectures and small group discussions are designed to increase physicians' comfort with and tolerance of sexual topics in the clinical setting. As part of the core curriculum of the second year, the course is offered as an "A" elective to a limited number of fourth-year students. (See course schedule for lecture times.)

Dr. G. Murphy

(B) Psychoanalysis. Introduction to Psychoanalytic Theory and its application to medicine and psychiatry: the psychoanalytic theory of personality will be discussed in a seminar in which the clinical practice aspects of the theory would be related to clinical medicine and psychiatry. A bibliography will be distributed and reading of basic books encouraged. Clinical material will be used to demonstrate the psychoanalytic theory and its applications. Seminars will be held in the Psychoanalytic Institute Building, 4524 Forest Park, Room 10. *Dr. A. Kaplan*



"B" Electives

(A) Outpatient and Community Psychiatry. This is a flexible clerkship tailored to the student's interests. Adult psychiatric patients in the Washington University Psychiatric Clinic present a variety of psychological and interpersonal problems similar to those encountered in the office practice of a psychiatrist, an internist, or a family physician. Students have an opportunity to learn a variety of treatment techniques under supervision. Students also manage patients in a community mental health center located in an inner-city area. There, students see how psychiatry works with social agencies, schools, and other institutions utilizing paramedical personnel in the detection and treatment of mental illness. *Dr. Smith*

(B) Clinical Psychiatry in Barnes Hospital. This is a fourth-year elective providing the student with an opportunity to learn clinical psychiatry by functioning as an extern on a six-week rotation. The student participates in a role similar to that of a first-year resident and attends all rounds and conferences for first-year psychiatry residents. The student takes night call approximately every fifth or sixth night. Supervision is by the chief resident and the director of the inpatient service. This rotation is particularly desirable for students going into family practice, general internal medicine, general pediatrics, or other nonpsychiatry specialties. The rotation provides an excellent opportunity to learn firsthand about psychiatric diagnosis, psychopharmacology, community resources, familial interventions, and further insights into the current literature. *Dr. Rubin*

(C) Child Psychiatry, Children's Hospital, and the Washington University Child Guidance Clinic. This clerkship in child psychiatry gives students an appreciation of the intricacies of diagnosis and treatment of emotionally disturbed children. The clerkship involves working up a small number of preadolescent as well as adolescent children under the supervision of senior staff members. Didactic teaching is available, as well as individual supervision of patients. Students gain an appreciation of both drug treatment and the limitations of drug treatment. They are exposed to the roles of community agencies such as settlement houses, juvenile courts, and various private agencies with which a child psychiatrist must work. Students also gain appreciation of the roles of nurse, social worker, teacher, and occupational therapist in collaboration with individuals of these disciplines. *Dr. F. Earls*

RESEARCH

Our research concerns the mechanisms and actions of excitotoxic amino acids such as glutamate (Glu), aspartate, and kainate in the central nervous system.

It ranges from human studies of Chinese Restaurant Syndrome to basic animal studies of Glu roles in neurotransmission, endocrinology, neuropathology, and development. Our techniques include neurohistopathological methods, such as electron microscopy, auto-radiography, and immunohistochemistry as well as neurochemical methods such as radioimmunoassay and receptor binding and reuptake studies. *Drs. Olney and M. Price*

Our investigations in psychiatric genetics attempt to understand the familial aggregation of the major psychiatric illnesses. We aim to characterize complex mechanisms of transmission and to localize abnormal genes using DNA Restriction Fragment Length Polymorphisms as linkage markers. A broad range of research opportunities are available, such as locating and interviewing families participating in genetic studies and working in a genetics lab. Laboratory techniques include the formation and culture of lymphoblastoid cell lines; DNA extraction; and the detection of DNA polymorphisms. Psychiatric disorders under study include schizophrenia; biopolar manic depressive illness; and alcoholism. *Dr. Reich*

Faculty

Head of Department

C. Robert Cloninger, M.D., Washington University, 1970; M.D. (hon.), Umea University, Sweden, 1983. (See Department of Genetics.)

Spencer T. Olin Professor

Samuel B. Guze, M.D., Washington University, 1945. (See Department of Medicine.)

Samuel and Mae S. Ludwig Professor

Theodore Reich, M.D., McGill University, 1963. (See Department of Genetics.)

Wallace Renard Professor

Eli Robins, M.D., Harvard University, 1943.

Professor Emeritus

Saul Rosenzweig (Medical Psychology), Ph.D., Harvard University, 1932. (Also Department of Psychology)

Professors

Theodore J. Cicero

(Neuropharmacology), Ph.D., Purdue University, 1968. (See Department of Anatomy and Neurobiology.)

John E. Helzer, M.D., University of Utah, 1967.

Blake W. Moore (Biochemistry), Ph.D., Northwestern University, 1952. (See Department of Biochemistry and Molecular Biophysics.)

George E. Murphy, M.D., Washington University, 1952.

John W. Olney, M.D., Iowa University, 1963. (See Department of Pathology.)

Dabceer C. Rao (Biostatistics), Ph.D., Indian Statistical Institute, 1971. (See Department of Genetics and Division of Biostatistics.)

John P. Rice (Mathematics), Ph.D., Washington University, 1975. (See Division of Biostatistics.)

Lee N. Robins (Sociology), Ph.D., Radcliffe College, 1951. (Also Faculty of Arts and Sciences)

William R. Sherman

(Biochemistry), Ph.D., University of Illinois, 1955. (See Department of Biochemistry and Molecular Biophysics.)

Brian K. Suarez (Genetics), Ph.D., University of California Los Angeles, 1974. (See Department of Genetics.)

Richard D. Wetzel (Medical Psychology), Ph.D., St. Louis University, 1974.

Research Professor

Mitchell Taibleson

(Mathematics), Ph.D., University of Chicago, 1962. (Also Faculty of Arts and Sciences)

Professors Emeriti (Clinical)

Margaret C. L. Gildea, M.D., Yale University, 1936.

Sydney B. Maughs, M.D., Washington University, 1935.

Professors (Clinical)

- Richard W. Hudgens**, M.D., Washington University, 1956.
Alex H. Kaplan, M.D., St. Louis University, 1936.
Patricia L. O'Neal, M.D., Washington University, 1948.
Marcel T. Saghir, M.D., American University of Beirut, 1963.

Associate Professors

- Mary L. Carlson** (Neurobiology), Ph.D., Tulane University, 1967. (See Department of Anatomy and Neurobiology.)
Robert M. Carney (Medical Psychology), Ph.D., Washington University, 1978.
Collins E. Lewis, M.D., Harvard University, 1971.
Eugene H. Rubin, M.D., Ph.D., Washington University, 1978.

Research Associate Professors

- Madelon T. Price** (Neurobiology), Ph.D., Washington University, 1973.
Elizabeth M. Smith (Social Work), Ph.D., Washington University, 1978.

Associate Professors (Clinical)

- John T. Biggs, Jr.**, M.D., University of Tennessee, 1968.
Jack L. Croughan, M.D., Kansas University, 1968.
Robert S. Hicks, M.D., University of Arkansas, 1958.
Edward H. Kowert, M.D., Washington University, 1943. (Malcolm Bliss Hospital)
Wanda M. Lamb, M.D., Washington University, 1948.
Jay L. Liss, M.D., Washington University, 1966.
Joe K. McKinney, M.D., Washington University, 1958.
Jay Meyer, M.D., St. Louis University, 1960.



- Paul M. Packman**, M.D., Washington University, 1963.
Thomas F. Richardson, M.D., Washington University, 1963.
E. Robert Schultz, M.D., Washington University, 1955. (See Department of Neurology and Neurological Surgery.)
James B. Smith, M.D., University of Missouri, 1967.
Harold D. Wolff, M.D., State University of Iowa, 1955.
Keith E. Isenberg, M.D., Indiana University, 1978.
Bruce L. Nock (Neurobiology), Ph.D., Rutgers University, 1980. (See Department of Anatomy and Neurobiology.)
Carol S. North, M.D., University of Iowa, 1977.
Jose V. Pardo, M.D., Ph.D., Johns Hopkins University, 1982.
Charles F. Zorumski, M.D., St. Louis University, 1978. (See Department of Neurology and Neurological Surgery.)

Assistant Professors

- Stephen H. Dinwiddie**, M.D., Eastern Virginia Medical School, 1982.
Wayne C. Drevets, M.D., University of Kansas, 1983.
Terrence S. Early, M.D., Duke University, 1982.
Kenneth E. Freedland (Medical Psychology), Ph.D., University of Hawaii, 1982.
Daniela S. Gerhard, Ph.D., Cornell University, 1982. (See Department of Genetics.)
Barry A. Hong (Medical Psychology), Ph.D., St. Louis University, 1978.

Research Assistant Professors

- Kevin D. Breault**, Ph.D., University of Chicago, 1986. (Also Department of Sociology)
Bruce A. Crosson (Medical Psychology), Ph.D., Texas Tech University, 1978. (See Department of Neurology and Neurological Surgery.)
Eric J. Devor (Genetics), Ph.D., University of New Mexico, 1979.

Ruth L. Fischbach (Sociology), Ph.D., Boston University, 1983. (See Department of Medicine.)

Paul P. Hipps (Biochemistry), Ph.D., North Dakota State University, 1971.

Michael P. Honchar (Neurochemistry), Ph.D., Washington University, 1976.

Lynn H. O'Connor (Neuroendocrinology), Ph.D., Rutgers University, 1983.

Paul Van Eerdewegh (Mathematics), Ph.D., Washington University, 1982.

Assistant Professors Emeriti (Clinical)

Robert M. Bell, M.D., St. Louis University, 1928.

Hyman H. Fingert, M.D., State University of Iowa, 1934.

Reese H. Potter, M.D., Washington University, 1935.

Assistant Professors (Clinical)

Bernardo G. Aleksander, M.D., University of Buenos Aires, 1959. (Malcolm Bliss Hospital)

Ahmad Ardekani, M.D., Pahlavi University, 1974.

William W. Clendenin, M.D., University of Tennessee, 1963.

Bun Tee Co, Jr., M.D., University of Santo Tomas, 1967. (Malcolm Bliss Hospital)

Juan C. Corvalan, M.D., Argentina National University, 1965.

Alejandro M. Datuin, M.D., University of Santo Tomas, 1965. (Malcolm Bliss Hospital.)

Mary Davis, M.D., Washington University, 1952.

Plaridel C. Deza, M.D., University of Santo Tomas, 1956. (Malcolm Bliss Hospital)

Terry A. Fuller, M.D., Washington University School of Medicine, 1974.

Fred W. Gaskin, M.D., University of Minnesota, 1968.

Frederick G. Hicks, M.D., University of Minnesota, 1981.

Sheldon G. Holstad (Pharmacy), Pharm.D., University of Iowa, 1986. (St. Louis College of Pharmacy)

Natarajan Lakshminarayanan, M.D., University of Madras, 1967. (Malcolm Bliss Hospital)

Patrick J. Lustman (Medical Psychology), Ph.D., Michigan State University, 1980.

Mary A. Montgomery, M.D., Northwestern University, 1973.

Rashmi R. Nakra, M.B.B.S., Lady Hardinge, 1970.

Eric J. Nuetzel, M.D., St. Louis University, 1976.

William M. Riedesel II, M.D., Cornell University, 1973.

James L. Rutherford, M.D., University of Iowa, 1980.

Jo-Ellyn M. Ryall, M.D., Washington University, 1975.

Paul W. Sheffner, M.D., Washington University, 1974.

Reed E. Simpson, M.D., Washington University, 1976. (Malcolm Bliss Hospital.)

Wayne A. Stillings, M.D., Washington University, 1975.

Richard H. Sundermann, Jr., M.D., Washington University, 1979.

Edwin D. Wolfgram, M.D., State University of Iowa, 1959.

Instructors

Michael R. Jarvis, Ph.D., University of Illinois, 1982; M.D., Washington University, 1985.

Saa'id Khojasteh, M.D., Shiraz University, 1981.

Mary Ann Kneesevich, M.D., Indiana University, 1981.

Elizabeth P. Negelow, M.D., St. Louis University, 1985.

Thomas J. Nowotny, M.D., Washington University, 1985.

Research Instructors

Andrea M. Allan, Ph.D., State University of New York, 1984.

Kathleen K. Bucholz, Ph.D., Yale University, 1986.

Juanita L. Carl (Biochemistry), A.M., Washington University, 1962.

Linda B. Cottler, Ph.D., Washington University, 1987.

Instructors (Clinical)

Dale J. Anderson, M.D., Washington University, 1979.

Scott J. Arbaugh, M.D., St. Louis University, 1985.

Michael T. Armour (Medical Psychology), Ph.D., Purdue University, 1984.

Anna K. Bradley (Social Work), M.S.W., Washington University, 1958. (Malcolm Bliss Hospital)

David M. Connor, M.D., University of Oklahoma, 1983.

Ranendra Ghosh, M.B.B.S., Patna Medical College, 1947. (Malcolm Bliss Hospital)

Menachem Givon (Medical Psychology), Ph.D., Southern Illinois University, 1970. (Malcolm Bliss Hospital)

David J. Goldmeier, M.D., Washington University, 1982.

Sonya N. Joseph, M.D., Cairo University, 1964. (Malcolm Bliss Hospital)

F. Timothy Leonberger (Medical Psychology), Ph.D., University of Southern Mississippi, 1986. (Malcolm Bliss Hospital)

Judith A. McGee (Medical Psychology), Ph.D., St. Louis University, 1979. (Malcolm Bliss Hospital)

Virgil L. Malmberg, M.D., University of Missouri, 1978.

James R. Mikolajczak, M.D., St. Louis University, 1972.

John F. Mueller (Social Work), M.S.W., Washington University, 1952. (Malcolm Bliss Hospital)

Alice G. Noel (Social Work), M.S.W., St. Louis University, 1976.

Mary M. Randlett (Medical Psychology), Ph.D., Iowa State University, 1978. (Malcolm Bliss Hospital)

Susan Reidhead (Medical Psychology), Ph.D., University of Missouri, St. Louis, 1985. (Malcolm Bliss Hospital)

Dean L. Rosen (Medical Psychology), Psy.D., University of Illinois, 1977. (Malcolm Bliss Hospital)

Luzviminda Santos, M.D., University of Santo Tomas, 1968. (Malcolm Bliss Hospital)

Robert K. Shaw (Medical Psychology), Ph.D., University of Missouri, 1984. (Malcolm Bliss Hospital)

Lecturers

Virginia Johnson-Masters (Human Sexuality), D.Sc. (hon.), University of Louisville, 1978.

William H. Masters (Human Sexuality), M.D., Rochester University, 1943; Sc.D. (hon.), Hamilton College, 1973. (See Department of Obstetrics and Gynecology.)

WILLIAM GREENLEAF ELIOT DIVISION OF CHILD PSYCHIATRY

The Division of Child Psychiatry offers a varied teaching program for medical students, residents in psychiatry, and fellows in child psychiatry at Children's Hospital. Outpatient services are organized through the Child Guidance Center located in St. Louis Children's Hospital and inpatient services are pro-

vided through a 16-bed psychiatric unit. Active consultation with all medical and surgical units of the hospital is also maintained. Trainees are assigned to these various services, where they participate in diagnostic evaluations and see patients in treatment under supervision.

Blanche F. Ittleson Professor and Director

Felton J. Earls (Child Psychiatry), M.D., Howard University, 1967. (See Department of Pediatrics.)

Professor Emeritus

E. James Anthony (Child Psychiatry), D.P.M., University of London, 1947; M.D., 1949.

Associate Professor

Zila Welner (Child Psychiatry), M.D., Hebrew University Hadassah Medical School, 1961. (See Department of Pediatrics.)

Associate Professor (Clinical)

Haruo Kusama (Child Psychiatry), M.D., Washington University, 1965.

Assistant Professor Emeritus

Loretta K. Cass Seleski (Medical Psychology), Ph.D., Ohio State University, 1950.

Assistant Professors

Richard D. Todd (Child Psychiatry), Ph.D., University of Texas, 1977; M.D., 1981.

Michele Van Eerdewegh (Child Psychiatry), M.D., Free University of Brussels, 1970.

Abby L. Wasserman (Child Psychiatry), M.D., Johns Hopkins University, 1970. (See Department of Pediatrics.)

Research Assistant Professor

Gwendolyn G. Reich (Anthropology Child Psychiatry), Ph.D., Washington University, 1978.

Assistant Professors (Clinical)

James E. Edwards (Child Psychiatry), M.D., University of Tennessee, 1962.

Paul H. Painter (Child Psychiatry), M.D., St. Louis University, 1947. (See Department of Pediatrics.)

Adolfo E. Rizzo (Child Psychiatry), M.D., Buenos Aires University, 1955.

Instructor Emeritus

Louetta Berger (Psychiatric Social Work), M.S.W., Washington University, 1946.

Instructor

Barbara S. Silverstein, M.S.W., Washington University, 1981.

Instructor (Clinical)

Vinod Suri, M.D., Punjab University, 1962. (Hawthorn Children's Psychiatric Hospital)

***DEPARTMENT OF
RADIOLOGY***



RADIOLOGY

The Mallinckrodt Institute of Radiology serves as the Department of Radiology, helping guide the consulting physician in the discovery, treatment and, ultimately, the healing of disease. Established in 1930, Mallinckrodt Institute has played a key role in radiological research, from the development of the first diagnostic test for gallbladder disease to current experimental work on shock-wave treatment of gallstones. In 1964, Mallinckrodt Institute scientists completed building the first cyclotron to be located in a United States medical center. This historic breakthrough led to the development at the Institute of positron emission tomography (PET) in the early 1970s. A second cyclotron was added in the late 1970s, making Mallinckrodt the only medical institution in the world to ever house two cyclotrons.

The Institute is located primarily in its own thirteen-story building, but also occupies space in the West Pavilion and Queeny Tower of Barnes Hospital, Barnard Hospital, Wohl Hospital, the Clinical Sciences Research Building, St. Louis Children's Hospital, the East Building on Scott Avenue, and the 4511 Forest Park facility. The department provides diagnostic radiology, nuclear medicine, radiation physics, and/or radiation oncology services to Barnes, Jewish, and Children's Hospitals. Occupying more than 350,000 total square feet, the Institute is one of the five largest and most modern radiological centers in the world.

Clinical facilities for the Radiation Oncology Center are located on the ground and first floors of the Institute, in Barnard Hospital, and in the West Pavilion. Therapy equipment consists of advanced 2100 C, 6-100, 20, and 4 MV linear accelerators and a Cobalt 60 therapy unit. Three state-of-the-art simulators and several computers are available for treatment planning. Also available are facilities and an ample stock of Cesium 137 sources for both interstitial and intracavity therapy and advanced equipment for interstitial and external hyperthermia. Remote afterloading devices are utilized for brachytherapy procedures.

The first floor of the Institute houses administrative offices, a film library, the reception and scheduling area, consulting viewing rooms, and the 150-seat Scarpellino Auditorium.

Seventy-four examination rooms for diagnostic radiology are available in the Institute, Queeny Tower, West Pavilion, Wohl Hospital, the East Building, and St. Louis Children's Hospital. Institute clinical facilities are located on the second floor (chest and musculoskeletal radiology and computed radiography); third floor (neuroradiology, digital vascular imaging, computed head tomography, and genitourinary radiology including lithotripsy); fourth floor (gastrointestinal radiology and ultrasound); and the fifth floor (magnetic resonance imaging and com-



puted body tomography). A clinical facility for positron emission tomography (PET) has just opened on the seventh floor. Interventional Radiology occupies the eighth floor. Cardiovascular radiology and the Division of Nuclear Medicine are located on the ninth floor of the West Pavilion. The tenth floor of the West Pavilion is dedicated entirely to outpatient radiologic services, including a comprehensive Breast Diagnostic Center. Orthopedic x-ray facilities are located on the eleventh floor of the West Pavilion and in the Wohl Clinic, and there are four radiologic examination rooms within the Barnes Emergency Department. In the north wing of Children's Hospital, the first floor houses a complete pediatric radiology facility offering ultrasound, nuclear medicine, computed tomography, and cardiac catheterization. The modern features of the Institute include seven CT scanners, four digital subtraction systems, and two magnetic resonance imaging systems.

The sixth floor of the Institute contains the Division of Radiation Sciences which utilizes a PET imaging system and two medical cyclotrons in Barnard Hospital. Additional research facilities are located on the third (hyperthermia) and sixth (physics) floors of Barnard Hospital, the 4511 Forest Park facility (cancer biology), the Clinical Sciences Research Building (radiation oncology, radiation sciences, nuclear medicine, and image processing), and the East Building (magnetic resonance imaging and electronic radiology). The Clinical Sciences Research Building also houses sophisticated computer facilities that are utilized for clinical, research, and teaching applications.

Administrative, teaching, and support functions occupy the ninth through eleventh floors of the Institute. A new administrative area currently occupies the twelfth floor. As part of the department's community outreach effort, Mallinckrodt operates a mobile mammography van that visits shopping malls,

community centers, and local businesses to provide mammography screening services for women in the St. Louis area.

The undergraduate teaching program is designed to present both diagnostic and therapeutic radiology to students as part of the clinical clerkship experience. Every effort is made to provide an opportunity to correlate radiologic and clinical findings through interdepartmental conferences, consultations, and group discussions.

FIRST YEAR

In their first year, medical students are first introduced to radiology in two separate ways. During the first semester of the gross anatomy course, students first are introduced into the world of radiology. Afternoon conferences are given by several members of the Radiology staff in the following areas: neuroradiology, chest, cardiac, bone and joint, and abdominal radiology. These sessions are arranged to coincide with the particular area of the body being studied in the anatomical dissection classes. Conferences are conducted in small groups giving students an opportunity to relate directly with the radiologists. *Dr. Gutierrez*

The second form of contact with radiology is offered in the form of a six-week elective seminar. This course seeks to reinforce the first semester anatomy experience by relating previously learned anatomical information to radiographic images. Radiologists from different subspecialties moderate these seminars in which students work in small units and present selected radiographic topics to the group. *Dr. Molina*

SECOND YEAR

Twenty hours of lecture are devoted to an introduction to radiology. The majority of the course is devoted to diagnostic radiology including computed tomography, ultrasound, and nuclear medicine. Radiation biology and radiation oncology are also introduced.

ELECTIVES

Research Electives

Opportunities are available to carry out research in the laboratories under the guidance of the staff in the fields of diagnostic radiology, therapeutic radiology, radiation physics, and nuclear medicine.

Dr. Gutierrez

Summer Oncology Clerkship for First-Year Students

A ten-week summer clerkship program is available for first-year medical and dental students. The students participate in the clinical activities of the Division of Radiation Oncology and are exposed to

the fundamental concepts of cancer biology and clinical radiation therapy in a series of lectures, seminars, and case presentation conferences. They have the opportunity to conduct some laboratory research or clinical investigation under the direction of the staff members of the sections of Clinical Radiation Oncology and Cancer Biology. *Drs. Simpson and Perez*

FOURTH YEAR ELECTIVES

Clerkship in Radiation Oncology

A four- or six-week elective in which the student has the opportunity to see patients being evaluated and treated in Radiation Oncology. Emphasis is on techniques of cancer diagnosis and localization, selection of therapy, indications for irradiation and techniques on treatment planning, simulation, and irradiation of a variety of tumors. There are several conferences in which the students participate, including new case-planning conferences, a clinical physics conference, a protocol conference, and interdepartmental conferences with the departments of Pediatrics, Obstetrics and Gynecology, Surgery, and Pathology. *Drs. Kuske or Perez*

Diagnostic Radiology Electives

The role of radiology in the solution of clinical diagnostic problems is emphasized in this clerkship. Each student on the rotation will spend one or two weeks on each of two or three subspecialty sections within the department (abdomen, bone and joint, cardiac, chest, neuroradiology, nuclear medicine, pediatric radiology, radiation oncology, and cross-sectional imaging) under the supervision of a senior faculty member. The student will have a chance to observe special procedures and emergency radiological examinations, as well as routine imaging studies. During the clerkship, the student will spend part of one evening reviewing films in the emergency room with the radiology resident on call. Conferences intended to complement the subspecialty approach to radiology round out this experience. *Dr. Gutierrez*

Clerkships in diagnostic radiology are also offered at Jewish Hospital (*Dr. Hyman Senturia*) and St. Luke's Hospital (*Dr. Mayes*).

Clinical Nuclear Medicine

A six-week elective in which the student will be exposed to the full range of techniques, including organ imaging with radionuclides, nuclear hematology, in vitro tests, and radionuclide therapy. The student will be responsible for planning appropriate isotope studies in patients referred to the department in conjunction with the staff. Opportunity exists to learn instrumental techniques, including new ones such as computer applications. Participation in clinical and laboratory research projects may also be arranged if desired. There are daily conferences and scan interpretation sessions. *Dr. B. Siegel*

Research projects are available in computer applications, evaluation of new radiopharmaceuticals, and clinical studies. Current computer research includes: 1) development of three-dimensional display software for tomographic positron imaging; 2) development of a department-wide image transmission and storage network using state-of-the-art hardware and network concepts; 3) application of

modern image processing techniques to nuclear medicine images. The student can undertake either practical computer problems, including program and hardware development, or more theoretical, mathematically-based projects. Prior training in calculus and some computer experience are essential for the computer-related research. *Dr. Miller*

Faculty

Elizabeth E. Mallinckrodt
Professor, Head of Department and Director of the Mallinckrodt Institute of Radiology

Ronald G. Evens, M.D.,
Washington University, 1964.
(Also Department of Economics)

Professors

James P. Crane, M.D., Indiana University, 1970. (See Departments of Genetics and Obstetrics and Gynecology.)

Mokhtar Gado, DMRE, Cairo University, 1960. (See Neurological Surgery.)

Louis A. Gilula, M.D., University of Illinois, 1967.

Robert L. Grubb, Jr. (Radiation Sciences), M.D., University of North Carolina, 1965.
(See Neurological Surgery.)

Fred J. Hodges III, M.D.,
University of Wisconsin, 1946.

R. Gilbert Jost, M.D., Yale University, 1969. (Also School of Engineering and Applied Science, Department of Computer Science)

Joseph K. T. Lee, M.D.,
Washington University, 1973.

Philip A. Ludbrook, M.B., B.S.,
University of Adelaide, 1963.
(See Department of Medicine.)

William H. McAlister, M.D.,
Wayne State University, 1954.
(See Department of Pediatrics.)

Bruce L. McClelland, M.D., State University of New York, Upstate, 1967.

G. Leland Melson, M.D.,
Washington University, 1965.

William A. Murphy, Jr., M.D.,
Pennsylvania State University,
1971.

Marcus E. Raichle (Radiation Sciences), M.D., University of Washington, 1964.
(See Department of Neurology and Neurological Surgery.)

Stuart S. Sagel, M.D., Temple University, 1965.

Gary D. Shackelford, M.D.,
Washington University, 1968.
(See Department of Pediatrics.)

Barry A. Siegel, M.D.,
Washington University, 1969.
(See Department of Medicine.)

Marilyn J. Siegel, M.D., State University of New York, 1969.
(See Department of Pediatrics.)

Michel M. Ter-Pogossian
(Radiation Sciences), Ph.D.,
Washington University, 1950.
(See Department of Medicine.)

Michael W. Vannier, M.D.,
University of Kentucky, 1976. (See Department of Surgery, Division of Plastic and Reconstructive Surgery.)

Michael J. Welch (Radiation Chemistry), Ph.D., University of London, 1965. (See Department of Medicine.) (Also Faculty of Arts and Sciences, Department of Chemistry)

Professor Emeritus (Clinical)

Hyman R. Senturia, M.D.,
Washington University, 1933.

Associate Professors

Dixie J. Anderson, M.D.,
Washington University, 1971.

Dennis M. Balfe, M.D., Medical College of Wisconsin, 1975.

G. James Blaine III, D.Sc.,
Washington University, 1974.
(See Institute for Biomedical Computing.)

Ralph V. Clayman, M.D.,
University of California, 1973.
(See Department of Surgery.)

Judy M. Destouet, M.D., Baylor College of Medicine, 1975.

John O. Eichling (Radiation Sciences), Ph.D., Washington University, 1970. (Also School of Dental Medicine)

Harvey S. Glazer, M.D.,
Washington University, 1976.

John K. Gohagan, Ph.D.,
Massachusetts Institute of Technology, 1973. (Also School of Engineering and Applied Science)

Fernando R. Gutierrez, M.D.,
University of Valladolid, 1974.

Jay P. Heiken, M.D., Columbia University, 1978.

Rexford L. Hill (Computer Sciences), M.S., University of Cincinnati, 1966. (Also School of Engineering and Applied Science, Department of Computer Science)

Robert C. McKnight, M.D.,
Washington University, 1961.
(See Department of Medicine.)

Tom R. Miller, Ph.D., Stanford University, 1971; M.D., University of Missouri, 1976.

William J. Powers (Radiation Sciences), M.D., Cornell University, 1975. (See Department of Neurology and Neurological Surgery.)

Henry D. Royal, M.D.,
St. Louis University, 1974.

William G. Totty, M.D.,
University of Tennessee, 1975.

Associate Professor Emeritus (Clinical)

A. Norman Arneson, M.D.,
Washington University, 1928.
(See Department of Obstetrics
and Gynecology.)

Associate Professors (Clinical)

Sumner Holtz, M.D., St. Louis
University, 1948.

Robert G. Levitt, M.D., University
of California, 1972.

Christopher J. Moran, M.D.,
St. Louis University, 1974.

Noah Susman, M.D., Washington
University, 1952. (Jewish Hospital)

Philip J. Weyman, M.D., Yale
University, 1972.

Assistant Professors

Jeffrey J. Brown, M.D.,
University of California, San Diego,
1983.

Michael D. Darcy, M.D., Ohio
State University, 1979.

Armand Diaz (Technical
Administration), R.N., R.T., Havana
University School of Medicine,
1948.

Edward M. Geltman, M.D.,
New York University, 1971.
(See Department of Medicine.)

Landis K. Griffeth, Ph.D., Duke
University, 1983; M.D., 1984.

Thomas E. Herman, M.D., Johns
Hopkins University, 1975.

Marshall E. Hicks, M.D.,
University of Kentucky, 1982.

Donald V. Huebener (Dental
Medicine), D.D.S., Washington
University, 1969. (See Department
of Pediatrics.)

Frederick A. Mann, M.D.,
Indiana University, 1975.

William D. Middleton, M.D.,
Duke University, 1981.

Mark A. Mintun, M.D.,
Washington University, 1981.
(See Departments of Medicine and
Neurology and Neurological
Surgery.)

Stephen M. Moerlein (Radiation
Chemistry), Ph.D., Washington
University, 1982.

Barbara Monsees, M.D.,
Washington University, 1975.

William H. Perman (Radiation
Sciences), Ph.D., University of
Wisconsin, Madison, 1980.

Daniel D. Picus, M.D., University
of Chicago, 1981.

Emily L. Smith, M.D.,
Washington University, 1968.

Alan J. Tiefenbrunn, M.D.,
Washington University, 1974.
(See Department of Medicine.)

Jerold W. Wallis, M.D., Stanford
University, 1981.

Anthony J. Wilson, M.B.Ch.B.,
Otago University, 1972.

Franz J. Wippold II, M.D., St.
Louis University, 1977.

John B. Zimmerman (Computer
Sciences), Ph.D., University of
North Carolina, 1985. (Also School
of Engineering and Applied
Science, Department of Computer
Science)

Research Assistant Professors

Peter T. Fox (Radiation Sciences),
M.D., Georgetown University,
1979. (See Department of
Neurology and Neurological
Surgery and Program in Physical
Therapy.)

Charles F. Hildebolt, D.D.S.,
Ohio State University, 1970; Ph.D.,
Washington University, 1987.

**Sampathkumaran S.
Kondapuram** (Nuclear
Medicine), M.S., McMaster
University, 1976. (See Department
of Medicine.)

Joel S. Perlmutter (Radiation
Sciences), M.D., University of
Missouri, 1979. (See Department
of Neurology and Neurological
Surgery.)

Assistant Professor Emeritus (Clinical)

Wayne A. Simril, M.D.,
Washington University, 1944.



Assistant Professors (Clinical)

- John L. Bardsley**, M.D., University of Illinois, 1964.
Edward Cohen, M.D., University of Missouri, 1969.
Enrique Cubillo, M.D., University of Madrid, 1962.
Gene L. Davis, Jr., M.D., University of Virginia, 1972.
James W. Debnam, Jr., M.D., University of Louisville, 1962.
Keith C. Fischer, M.D., Johns Hopkins University, 1971.
Guillermo C. Geisse, M.D., University of Chile, 1965.
Albert E. Hesker, M.D., University of Missouri, 1964.
Daniel J. Leary, Jr., M.D., Washington University, 1966.
Allan H. McCown, M.D., Washington University, 1964.
Ben R. Mayes, Jr., M.D., Washington University, 1966.
Gary H. Omell, M.D., University of Tennessee, 1967.
Naris Rujanavech, M.D., Faculty of Medicine, Siriraj Hospital, 1972.
Robert F. Scheible, M.D., Washington University, 1972.
Chandrakant C. Tailor, M.B., B.S., Maharaja Sayajirao University of Baroda, 1972.

Instructors

- William W. Baber**, M.D., University of Arkansas, 1984.
Bruce L. Bower, M.D., Hahnemann University, 1982.
Holly J. Burge, M.D., Ohio State University, 1985.
C. David Burtner, M.D., Medical College of Virginia, 1985.
Ted J. Cardoso, M.D., Medical College of Virginia, 1985.
Steven S. Eilenberg, M.D., George Washington University, 1985.
Mark S. Frank, M.D., Washington University, 1984.
Robert J. Gropler, M.D., University of Cincinnati, 1981.

Margaret R. Linn, M.D., Vanderbilt University, 1984.

Andrea H. McGuire, M.D., Creighton University, 1982.

Scott A. Mirowitz, M.D., Washington University, 1985.

Paul L. Molina, Jr., M.D., University of North Carolina School of Medicine, 1983.

Thong H. Nguyen, M.D., University of Iowa, 1984.

Michael P. Postma, M.D., University of Florida, 1985.

Edward S. Rollins, M.D., Washington University, 1984.

Farrokh Dehdashti Shahrokh, M.D., Pahlavi University, Iran, 1977.

Jonas Singer, M.D., University of the Witwatersrand, South Africa, 1979.

Steven L. Solomon, M.D., University of Chicago, 1985.

James N. Suojanen, M.D., University of Rochester, 1979.

Paul J. Tobben, M.D., Vanderbilt University, 1984.

Research Instructor

James W. Brodack (Radiation Sciences), Ph.D., Massachusetts Institute of Technology, 1983.

Instructors (Clinical)

- Stephen F. Albert**, M.D., St. Louis University, 1968.
Arthur F. Bishop, M.D., University of Illinois, 1977.
Albert M. Hammerman, M.D., Washington University, 1976.
James A. Junker, M.D., St. Louis University, 1979.
Lawrence M. Kotner, Jr., M.D., Washington University, 1968.
Edward F. Ragsdale, M.D., Washington University, 1964.
Gerald L. Shaikun, M.D., University of Chicago, 1964.
Gene W. Spector, M.D., Yale University, 1959.

Research Associates

- David E. Beecher**, M.S., Washington University, 1980.
David C. Ficke, B.S.E.E., Southern Illinois University, 1974.
Donald E. Gayou, Ph.D., Iowa State University, 1979.
Dah-Ren Hwang, Ph.D., State University of New York, 1982.
Gregory S. Lannoye, Ph.D., University of Wisconsin, Milwaukee, 1986.
Thomas K. Pilgram, Ph.D., University of California, 1982.

Research Assistants

- Carmen S. Dence**, M.S., Florida State University, 1972.
Gary R. Hoffman, B.A., University of Missouri, 1976.
Carla J. Mathias, B.A., Depauw University, 1976.

Consultant

Mildred Trotter (Anatomy), Ph.D., Washington University, 1924; Sc.D., (hon.), Western College, 1956; Sc.D., (hon.), Mount Holyoke College, 1960; Sc.D., (hon.), Washington University, 1980. (See Department of Anatomy and Neurobiology.)

DIVISION OF RADIATION ONCOLOGY

Professor and Director

Carlos A. Perez, M.D., University of Antioquia, 1960.

Professor Emeritus and Lecturer

Leonard J. Tolmach (Cancer Biology), Ph.D., University of Chicago, 1951.

Professors

Bahman Emami, M.D., Tehran University, 1968.



Hsiu-san Lin, M.D., Taiwan University, 1960; Ph.D., University of Chicago, 1968. (See Department of Molecular Microbiology.)

James A. Purdy (Radiation Physics), Ph.D., University of Texas, 1971.

Joseph L. Roti Roti (Cancer Biology), Ph.D., University of Rochester, 1972.

Patrick R. M. Thomas, M.B., B.S., London University, 1968.

Teresa J. Vietti (Radiation Oncology), M.D., Baylor University, 1953. (See Department of Pediatrics.)

Todd H. Wasserman, M.D., University of Rochester School of Medicine and Dentistry, 1972.

Associate Professors

Gilbert H. Nussbaum (Radiation Physics), Ph.D., Harvard University, 1967.

Joseph R. Simpson, Ph.D., University of Chicago, 1967; M.D., Harvard University, 1973.

Larry D. Simpson (Radiation Physics), Ph.D., University of Kansas, 1971.

Associate Professor (Clinical)

Bruce J. Walz, M.D., Washington University, 1966.

Assistant Professors

Venkata R. Devineni, M.D., Osmania Medical College, 1974.

Robert E. Drzymala (Radiation Physics), Ph.D., University of Oklahoma, 1977.

Delia M. Garcia, M.D., Southern Illinois University, 1979.

Perry W. Grigsby, M.D., University of Kentucky, 1982.

Robert R. Kuske, M.D., University of Cincinnati, 1980.

Peter P. Lai, Ph.D., University of Illinois, 1977; M.D., University of Pennsylvania, 1984.

Andrei Laszlo (Cancer Biology), Ph.D., University of California, 1981.

Robert J. Myerson, Ph.D., University of California, 1974; M.D., University of Miami, 1980.

Yvonne C. Taylor (Cancer Biology), Ph.D., University of Toronto, 1981.

Martin S. Weinhaus (Radiation Physics), Ph.D., University of New Hampshire, 1974.

John Wai-chiu Wong (Radiation Physics), Ph.D., University of Toronto, 1982.

Research Assistant Professor

Ryuji Higashikubo (Cancer Biology), Ph.D., Bowling Green State University, 1978.

Assistant Professors (Clinical)

Robert J. Baglan, Ph.D., University of California, 1970; M.D., Washington University, 1976.

Fransiska Lee, M.D., Washington University, 1966.

MacDonald B. Logie, M.D., Northwestern University, 1967.

Instructors

Seymour Fox (Computer Sciences), Ph.D., University of Oklahoma, 1977.

Russell L. Gerber (Radiation Physics), M.S., St. Louis University, 1985.

William B. Harms, Sr. (Radiation Physics), B.S., University of Missouri, 1979.

Corbin R. Johnson, M.D., Washington University, 1985.

Eric E. Klein, M.S., University of Massachusetts, 1985.

Henry K. Lee, M.D., Wayne State University, 1985.

Leonid Leybovich (Radiation Physics), M.S.E.E., Washington University, 1985.

Richard D. Lovett, M.D., University of Vermont, 1985.

Victor Marcial-Vega, M.D., University of Puerto Rico School of Medicine, 1984.

Daniel F. Mullen (Computer Sciences), D.D.S., University of Missouri, 1977.

Susan J. Shapiro, M.D., University of Chicago, 1983.

Eric D. Slessinger (Radiation Physics), M.S., St. Louis University, 1986.

James H. Wynstra, M.D., Medical College of Wisconsin, 1985.

Instructor (Clinical)

Gary A. Ratkin, M.D., Washington University, 1967. (See Department of Medicine.)

Research Associates

Michael A. Mackey (Cancer Biology), Ph.D., University of California, San Francisco, 1987.

John W. Matthews (Radiation Physics), D.Sc., Washington University, 1980. (See Institute for Biomedical Computing.)

Research Assistants

Francisco Li-Aravena (Radiation Physics), M.S., Southern Illinois University, Carbondale, 1984.

Ying Su (Radiation Physics), B.S., Tianjin University, China, 1982.

Consultant

Jose Maria V. Sala, M.D., Universidad Del Litoral, 1944.

MARY CULVER

DEPARTMENT OF

SURGERY



SURGERY

The Department of Surgery includes cardiothoracic surgery, general surgery, orthopedic surgery, pediatric surgery, plastic surgery and urologic surgery. The formal instruction begins in the second year with an introductory course designed to provide the student with an understanding of the clinical and research characteristics of general surgery and the surgical specialties.

In the third year, students are assigned clinical clerkships where they have an opportunity to participate in the care of surgical patients. The clerkship lasts for twelve weeks and is spent at one or more of the hospitals in the Washington University Medical Center. Students attend daily patient rounds with the house staff and attending staff. Seminars and teaching conferences are scheduled on a regular basis.

In the fourth year, students may select a sub-internship or an elective, most of which are for periods of six to eighteen weeks. During the sub-internship or preceptorship, the student is assigned to a staff member for instruction in the diagnosis and management of surgical problems. Electives are available in pediatric surgery, thoracic and cardiovascular surgery, orthopedic surgery, urologic surgery, oncologic surgery, transplantation surgery and emergency room surgery.

SECOND YEAR

Introduction to Surgery

This course consists of 6 two-hour lectures in general surgery, cardiothoracic surgery, plastic surgery, urologic surgery, orthopedic surgery and pediatric surgery. The surgical faculty presents the lectures which are designed to familiarize the student with the clinical and investigative opportunities of the various surgical disciplines.

THIRD YEAR

Surgical Wards

The majority of this 12-week course is devoted to general surgery. Students are assigned to rotations at either Barnes Hospital or Jewish Hospital. Students are active participants in the care of assigned patients. Formal conferences consist of case presentations to the faculty, core lectures in surgical pathophysiology, ward rounds, and departmental and divisional rounds.

FOURTH YEAR

The fourth-year students are offered clinical rotations either as subinternships or electives.



Surgical Preceptorships and Subinternships

Each student is assigned to a senior general surgeon. The student sees patients in the clinic and takes case histories, performs physical examinations, and follows patients admitted to the hospital. *Dr. Wells*

Cardiothoracic Surgery Elective

The senior elective in Cardiothoracic Surgery is a six-week clinical rotation. Students have the choice of spending the entire six weeks in adult cardiac surgery, adult non-cardiac thoracic surgery, or in pediatric cardiac surgery. If the student wishes, the six-week rotation can be divided into any combination of the above three sub-rotations. While on the Cardiothoracic Surgery Service, students will round daily with the Cardiothoracic Surgery House Staff, participate in operative procedures of their choice, attend weekly Cardiac Catheterization Conference (combined Cardiology and Cardiothoracic Surgery), and attend teaching rounds. Students are also encouraged to spend time with the cardiopulmonary bypass team and to participate actively in postoperative care in the 2300 Intensive Care Unit.

Dr. Cox and Staff

Critical Care--Burns Elective

This critical care elective will familiarize the student with the management of the severely burned patient. The student will function as an integral part of the Burn Center Critical Care Team. Practical experience will be gained in ventilatory support measures in patients with inhalation injuries, in fluid and electrolyte resuscitation, in metabolic and nutritional management and in the logistics and technical aspects of wound care and coverage. Students will participate in daily teaching rounds with the surgical and nursing staff and with the Director of the Center, and during the elective, will prepare an in-depth presentation on a selected aspect of the field for one of the weekly formal conferences.

Dr. Bessey and Staff

Emergency Surgery Elective

Students will function as subinterns under the direct supervision of the attending and resident staffs. Students will assume primary responsibility for the evaluation and management of a variety of medical and surgical emergencies and will participate in rounds and conferences. Each student delivers a formal presentation on a subject pertinent to emergency medicine during the latter portion of the clerkship.

Dr. Bessey and Staff

General Surgery Elective

Each student will be assigned to the general surgery resident ward and will function as a member of the team, sharing most of the duties of an intern. The student will share night call under supervision of first and second year residents in rotation with the two ward interns. In addition, part of the elective may be taken in the Surgical Intensive Care Unit. The purpose of this portion of the elective is to familiarize the student with the care of the critically ill surgical patient. Rounds are made every morning with faculty members from the Department of Surgery and a senior surgical resident. Students are encouraged to participate actively in these rounds. They are also encouraged to read about the problems they encounter and to participate as integral members of the team providing care for the patients. *Dr. Anderson and Staff*

Jewish Hospital Clerkship

The senior clerkship at Jewish Hospital is an extremely flexible program. Within the framework of providing a good background in and experience with surgical diseases, many approaches are allowable. A student may divide the six weeks here choosing some time on a subspecialty or spending all of the rotation as a surgical subintern. Preceptorships with the attending staff are available and have been popular. *Dr. Philpott and Staff*

**Organ Transplantation Elective**

The care of transplantation patients requires the integration of multiple diverse medical and surgical disciplines. This elective clerkship in organ transplantation encompasses preoperative cadaveric and living related donor evaluation for adult and pediatric recipients of kidney, liver and pancreatic grafts as well as associated operative procedures in patients with end organ failure. Emphasis is placed on postoperative care, multimodality immunosuppression, management of allograft rejection and organ retrieval and preservation. Basic hepatic, pancreatic and renal physiology, fluid and electrolyte balance, operative techniques and transplantation immunology are stressed. Management of the complications of diabetes, portal hypertension and infectious diseases are a part of the complete management of these patients. This course is designed to offer the student an overview of the field of organ transplantation. The student functions as an integral part of the transplant team and assumes appropriate responsibilities under supervision. A vigorous and varied clinical schedule should be anticipated. An interview is recommended prior to selecting this elective.

Dr. Hanto and Staff

Orthopedic Hand Surgery Elective

A clinical elective will be available for a 6-week period, during which time the student will work with attending surgeons primarily at Barnes Hospital. Activities will include participation in the care of hospitalized inpatients, participation in inpatient and outpatient procedures, attendance at designated attending office hours, attendance at designated orthopedic conferences, and dissection of upper extremity anatomical specimens. *Dr. Manske and Staff*

Orthopedic Surgery Elective

A clinical clerkship elective will be available for 6, 12 or 18 weeks, during which time the student will attend conferences and outpatient clinics. The student will also serve as a clerk in the various orthopedic clinical rotations, that is, at Barnes Hospital, St. Louis Regional Medical Center, John Cochran Veterans Administration Hospital and St. Louis Shriners Hospital for Crippled Children. Medical students electing this clerkship will serve as active and integral members of the team. Conferences and clinics that the student will be expected to attend consist of: Adult Clinics, Mondays and Thursdays; Children's Clinics, Tuesdays and Thursdays; Hand Conference, 4:00 p.m., Wednesdays; Orthopedic Grand Rounds, 6:45 a.m., Tuesdays; X-ray Conference, 6:40 a.m., Wednesdays; and Saturday Conferences: Pediatrics, 7:00 a.m.; Basic Science, 8:00 a.m. *Dr. Blair*

Pediatric Surgery Elective

The student will fully participate as a subintern in all aspects of pediatric surgical patient care, including

preoperative evaluation, surgery and postoperative care. Twice daily rounds are made with the resident staff and daily rounds with the attending staff. Participation in general surgery pediatric clinic, emergency room care, pediatric oncology conference and weekly conference in pediatric surgical conditions, as well as daily contact with Pediatric Radiology, are expected. Students are encouraged to undertake clinical investigations if elective time permits.

Dr. Ternberg and Staff

Plastic and Reconstructive Surgery Elective

The period on plastic surgery may either be spent as a clinical clerk or conducting a basic laboratory project. The purpose of the clinical clerkship is to familiarize the student with the basic principles of tissue repair and reconstruction. The student will have successive assignments to each of the attending staff and the ward resident during the six weeks. This will provide exposure to the breadth and depth of plastic surgery. The student will assume an active role on the plastic surgery service and will participate in the total management of a wide variety of surgical problems including congenital anomalies, head and neck cancer, surgery of the upper extremity, cosmetic and reconstructive plastic surgery. The research clerkship will be conducted in the Plastic Surgery laboratory under the direction of Drs. Logan, Marsh, Mustoe or Weeks. A project will be designed with the student prior to his/her rotation on Plastic Surgery so that all the materials and methods will be available at the beginning of the rotation. Ongoing projects include: (1) the mechanical, structural and biochemical effects of stress on scar tissue maturation;

(2) nerve repair and regeneration; (3) the biomechanical characteristics of the ligaments of the wrist; (4) computer graphics of wrist motion; and (5) the effect of growth factors on wound healing.

Dr. Weeks and Staff

St. Louis Regional Medical Center Elective

Students work under the supervision of the chief resident in Surgery and are integral members of the surgical team. Ward rounds are made twice daily. Students are assigned new patients for complete history and physical examinations and are expected to formulate a plan of diagnosis and treatment. Students assist in the operating room on their patients as well as at the direction of the chief resident. Students attend the weekly teaching conference at 8:15 a.m. on Tuesdays and the Mortality and Morbidity Conference held on alternate weeks, and attend the General Surgery Conferences at Barnes Hospital as well. Night call is shared with a surgical assistant resident. *Dr. Monafio*

Urology Elective

A six-week clinical clerkship in Pediatric and/or Adult Urology will offer the interested student experience with a spectrum of problems in clinical urology. The student will learn the basic diagnostic procedures and management of surgical and non-surgical aspects of patient care on the private and ward services under the supervision of the attending staff and house officers. Clinical conferences are held four days per week and pyelogram conferences are held daily. *Dr. Catalona and Staff*

Faculty

**Bixby Professor of Surgery,
Chairman, Department of
Surgery**

Samuel A. Wells, Jr., M.D.,
Emory University, 1961.

DIVISION OF CARDIOTHORACIC SURGERY

Head of Division

James L. Cox, M.D., University of
Tennessee, 1967.

**John M. Shoenberg Professor
of Cardiovascular Surgery**

Nicholas T. Kouchoukos, M.D.,
Washington University, 1961.
(Jewish Hospital)

Professors

John P. Boineau, M.D., Duke
University, 1959.

Joel D. Cooper, M.D., Harvard
College, 1964.

Professors (Clinical)

Thomas B. Ferguson, Sr., M.D.,
Duke University, 1947.

Charles L. Roper, M.D.,
University of Colorado, 1953.

Associate Professor

Thomas L. Spray, M.D., Duke
University, 1973.

Associate Professor (Clinical)

Martin Bergmann, M.D.,
Washington University, 1945.
(Jewish Hospital)

Assistant Professors

T. Bruce Ferguson, Jr., M.D.,
Washington University, 1979.

Larry R. Kaiser, M.D., Tulane
University, 1977.

Michael K. Pasque, M.D.,
University of Oklahoma, 1978.

Michael Rosenbloom, M.D.,
New York University, 1981.

Research Assistant Professors

Richard B. Schuessler, Ph.D.,
Clemson University, 1977.

Thomas H. Wareing, M.D.,
University of Alabama, 1979.

Instructors

Thomas M. Egan, M.D.,
University of Toronto, 1976.

Christina C. Pasque, M.D.,
University of California, Los
Angeles, 1980.

DIVISION OF GENERAL SURGERY

Head of Division

Charles B. Anderson, M.D., Yale
University, 1962.

Harry Edison Professor of Surgery

Gordon W. Philpott, M.D.,
Washington University, 1961.
(Jewish Hospital)

Professors Emeriti

Eugene M. Bricker, M.D.,
Washington University, 1934.

J.G. Probst, M.D., Loyola
University, 1917.

Professors

Walter F. Ballinger, M.D.,
University of Pennsylvania, 1948.

M. Wayne Flye, M.D., University
of North Carolina, Chapel Hill,
1967; Ph.D., Duke University,
1980. (See Department of
Molecular Microbiology.)

Thalachallour Mohanakumar,
Ph.D., Duke University, 1974.
(See Departments of Medicine and
Pathology.)

William W. Monafo, Jr., M.D.,
Tufts University, 1957.

Gregorio A. Sicard, M.D.,
University of Puerto Rico, 1972.

Associate Professors

James M. Becker, M.D., Case
Western Reserve University, 1975.

Palmer Q. Bessey, M.D.,
University of Vermont, 1975.

John D. Halverson, M.D., State
University of New York, 1967.

Ira J. Kodner, M.D., Washington
University, 1967. (Jewish Hospital)

David W. Scharp, M.D.,
Washington University, 1970.

Research Associate Professor

William G. Dilley, Ph.D.,
University of California, 1970.

Associate Professor Emeritus (Clinical)

Leo A. Sachar, M.D., Washington
University, 1940. (Jewish Hospital)

Associate Professors (Clinical)

Richard V. Bradley, M.D.,
Washington University, 1952.

Ralph J. Graff, M.D., Washington
University, 1957. (See Department
of Genetics.)

Robert H. Lund, Jr. M.D.,
Washington University, 1949.

William D. Shieber, M.D.,
Washington University, 1953.
(Jewish Hospital)

Richard G. Sisson, M.D., Yale
University, 1946. (Jewish Hospital)

George L. Tucker, M.D., Harvard
University, 1956.

Willard B. Walker, M.D.,
Washington University, 1946.

Assistant Professors

Brent T. Allen, M.D., Washington
University, 1979.

Dorothy P. Andriole, M.D.,
New York University, 1980.

L. Michael Brunit, M.D., Johns
Hopkins University, 1980.

James W. Fleshman, Jr., M.D.,
Washington University, 1980.

Robert D. Fry, M.D., Washington
University, 1972. (Jewish Hospital)

Jerome J. Gilden, M.D.,
Washington University, 1952.
(Jewish Hospital)

Douglas W. Hanto, M.D.,
University of Arizona, 1977; Ph.D.,
University of Minnesota, 1987.

Martin D. Jendrisak, M.D., Ohio
State University, 1978.

William G. Kraybill, M.D.,
University of Cincinnati, 1969.

Marvin J. Lopez, M.D.,
Universidad Autonoma de
Guadalajara, Mexico, 1970.

J. Wallis Marsh, Jr., M.D.,
University of Arkansas, 1979.

Jeffrey F. Moley, M.D., Columbia
University, 1980.

Nathaniel J. Soper, M.D.,
University of Iowa, 1980.

Michael A. West, M.D.,
Loyola-Stritch School of Medicine,
1980; Ph.D., University of
Minnesota, 1988.

Research Assistant Professor Emeritus

Harry W. Margraf, Ph.D.,
Polytechnic Milan, 1943; Sc.D.,
Washington University, 1971.
(Jewish Hospital)

Research Assistant Professors

Judith M. Connert, Ph.D.,
Washington University, 1979.
(Jewish Hospital)

Phillip Gambel, Ph.D.,
Pennsylvania State University,
1980.

Assistant Professors (Clinical)

Kenneth J. Arnold, M.D.,
Washington University, 1968.

Kenneth J. Bennett, M.D.,
Tulane University, 1965. (Jewish
Hospital)

Richard H. Fallon, M.D., Harvard
University, 1956.

Alvin Goldfarb, M.D.,
Washington University, 1943.
(Jewish Hospital)

Jerome F. Levy, M.D.,
Washington University, 1958.

Stanley L. London, M.D.,
Washington University, 1949.
(Jewish Hospital)

Sherwin H. Malt, M.D.,
University of Missouri, 1966.
(Jewish Hospital)

Jerry R. Meyers, M.D.,
Washington University, 1966.

Shale M. Rifkin, M.D.,
Washington University, 1948.
(Jewish Hospital)

Andrew D. Spencer, M.D.,
Indiana University, 1954.

Instructors Emeriti

Virgil O. Fish, M.D., Washington University, 1930.

George C. Wee, M.D., University of Louisville, 1931.

Instructors

Christopher S. McCullough, M.D., University of Virginia, 1978.

John S. Munn, M.D., University of Michigan, 1983.

Lloyd E. Ratner, M.D., Hahnemann University, 1983.

Marlys E. Schuh, M.D., Washington University, 1979. (Jewish Hospital)

Research Instructor

Martin Mangino, Ph.D., Michigan State University, 1985.

Instructors (Clinical)

Jerry L. Beguelin, M.D., Washington University, 1962.

John B. Buettner, M.D., Washington University, 1967.

Steven W. Cooley, M.D., Louisiana State University, 1977.

Arthur R. Dalton, M.D., Northwestern University, 1941.

Ronald J. Gaskin, M.D., Washington University, 1970.

Joseph H. Gatewood, M.D., University of Chicago, 1970.

Jay W. Haines, M.D., Chicago Medical School, 1974.

Fleming B. Harper, M.D., Medical College of Virginia, 1947.

Thomas C. Hill, M.D., Washington University, 1972.

Elizabeth Hilliker, M.D., Washington University, 1970.

John D. Hirsch, M.D., Washington University, 1973. (Jewish Hospital)

Ronald Kinateder, M.D., University of Missouri, 1966.

Robert J. Kingsbury, M.D., University of Michigan, 1960.

David P. Krajcovic, M.D., Washington University, 1969.

G. Lynn Krause, Jr., M.D., University of Pennsylvania, 1954.

Alan M. Londe, M.D., Washington University, 1961.

Julian C. Mosley, Jr., M.D., Washington University, 1972.

George A. Oliver, M.D., Washington University, 1952.

Charles L. Parks, M.D., Washington University, 1969.

Joseph C. Peden, Jr., M.D., Harvard University, 1943.

Mather Pfeifferberger, Jr., M.D., Harvard University, 1944.

Gary Quick, M.D., University of Pittsburgh, 1972.

Frank O. Richards, M.D., Howard University, 1947. (Jewish Hospital)

Donald C. Sauer, M.D., Washington University, 1960. (Jewish Hospital)

David Siroospour, M.D., Shiraz University, Iran, 1967.

Calvin B. Terrell, M.D., Washington University, 1977.

Belmont R. Thiele, M.D., St. Louis University, 1948.

Jeffrey E. Zuke, M.D., University of Missouri, 1979.

DIVISION OF ORAL AND MAXILLOFACIAL SURGERY

Head of Division

Allen Sclaroff, D.D.S., Temple Health Science Center, 1972.

Professor

Louis Altshuler, D.D.S., Ohio State University, 1945.

Assistant Professors

Marc B. Abrams, D.D.S., University of Missouri, 1972.

Herman Turner, D.D.S., St. Louis University, 1946.

Lecturer

Leroy W. Peterson, D.D.S., University of Michigan, 1940.

DIVISION OF ORTHOPEDIC SURGERY

Fred C. Reynolds Professor and Head of Division

Paul R. Manske, M.D., Washington University, 1964. (See Irene Walter Johnson Institute of Rehabilitation.)

Professor Emeritus

Lee T. Ford, M.D., University of Tennessee, 1940.

Associate Professors

Perry L. Schoenecker, M.D., University of Wisconsin, 1968.

William B. Strecker, M.D., St. Louis University, 1975.

Associate Professor Emeritus (Clinical)

Marshall B. Conrad, M.D., Washington University, 1945.

Associate Professor (Clinical)

Harry C. Morgan, M.D., Harvard University, 1953.

Assistant Professor Emeritus

J. Otto Lottes, Ph.G., St. Louis College of Pharmacy, 1928; M.D., University of Louisville, 1937.

Assistant Professors

Vilray P. Blair III, M.D., Duke University, 1977.

Keith H. Bridwell, M.D., Washington University, 1977.

Clayton R. Perry, M.D., St. Louis University, 1977.

Margaret M. Rich, M.D., Northwestern University, 1976; Ph.D., 1977.

Robert A. Shively, M.D.,
University of Illinois, 1969.

Charles J. Sutherland, M.D.,
Yale University, 1971.

Research Assistant Professors

Jean E. Childers, Ph.D., Rice University, 1970.

Jeffrey H. Owen, Ph.D.,
University of Arizona, 1979.

Leo A. Whiteside, M.D.,
University of Texas Southwestern Medical School, 1969.

Assistant Professors (Clinical)

James C. Ellsasser, M.D.,
Washington University, 1964.

Jerome J. Gilden, M.D.,
Washington University, 1952.
(Jewish Hospital)

Jordon H. Ginsburg, M.D.,
University of Illinois, 1972.
(Jewish Hospital)

Robert E. Kuhlman, M.D.,
Washington University, 1956.

Marvin R. Mishkin, M.D.,
University of Illinois, 1955.
(Jewish Hospital)

George E. Scheer, M.D.,
Washington University, 1943.

Instructors

Richard E. Hulsey, M.D.,
University of Missouri, Columbia, 1983.

Daniel J. McGuire, M.D.,
Creighton University, 1982.

Richard L. Pearson, M.D.,
University of Illinois, Chicago, 1974.

Donald L. Pruitt, M.D.,
New Jersey Medical School, 1983.

Research Instructors

S. Vic Glogovac, M.D.,
Washington University, 1973.

Kenton N. Fedde, Ph.D.,
University of Chicago, 1983.

Instructors (Clinical)

David J. Anderson, M.D., St. Louis University, 1983.

Donald R. Bassman, M.D.,
Washington University, 1975.
(Jewish Hospital)

Donald H. Brancato, M.D.,
Northwestern University, 1967.

William S. Costen, M.D.,
Washington University, 1954.

James P. Emanuel, M.D.,
Washington University, 1983.

Ronald C. Hertel, M.D.,
Washington University, 1956.

Barrett K. Holder, M.D.,
Washington University, 1969.

Robert C. Lander, M.D.,
University of Illinois, 1972.

W. Edward Lansche, M.D.,
Washington University, 1952.

Charles I. Mannis, M.D.,
University of Missouri, Columbia, 1969. (Jewish Hospital)

Alan H. Morris, M.D., University of Illinois, 1963. (Jewish Hospital)

David L. Nelson, M.D., George Washington University, 1982.

Margaret M. Oakley, M.D.,
St. Louis University, 1959. (Shriners Hospital for Crippled Children)

Jerome G. Piontek, M.D.,
St. Louis University, 1979.

Richard D. Rames, M.D., Rush Medical College, 1983.

Barry L. Samson, M.D.,
Washington University, 1974.
(Jewish Hospital)

John J. Sheridan, M.D.,
Washington University, 1969.
(Shriners Hospital for Crippled Children)

Keith R. Swanson, M.D.,
University of Texas, Galveston, 1971. (Shriners Hospital for Crippled Children)

Michael H. Winer, M.D.,
University of Illinois, 1968.
(Jewish Hospital)

Assistants (Clinical)

John P. Arnot, M.D., Yale University, 1958.

Kyu Sop Cho, M.D., Yon-Sei University, 1954.

Herman E. Russell, M.D.,
University of Geneva, 1956.

George R. Schoedinger III, M.D., University of Oregon, 1962.

DIVISION OF PEDIATRIC SURGERY

Head of Division

Jessie L. Ternberg, Ph.D.,
University of Texas, 1950; M.D.,
Washington University, 1953; Sc.D.
(hon.), Grinnell College, 1972.
(See Department of Pediatrics.)

Associate Professor

Richard J. Bower, M.D.,
University of Virginia, 1969. (See
Department of Pediatrics.)

DIVISION OF PLASTIC AND RECONSTRUCTIVE SURGERY

Head of Division

Paul M. Weeks, M.D., University of North Carolina, 1958. (See Irene Walter Johnson Institute of Rehabilitation.)

Professor Emeritus

Minot P. Fryer, M.D., Johns Hopkins University, 1940; D.S.C., Brown University, 1972.

Professor

Jeffrey L. Marsh, M.D., Johns Hopkins University, 1970.
(See Department of Pediatrics.)

Associate Professor

V. Leroy Young, M.D., University of Kentucky, 1970.

Assistant Professors

George J. Hruza, M.D., New York University, 1982.

Bruce A. Kraemer, M.D.,
Washington University, 1979.

Samuel E. Logan, Ph.D.,
California Institute of Technology, 1972; M.D., University of California, Los Angeles, 1976.

Thomas A. Mustoe, M.D.,
Harvard Medical School, 1978.

Kathryn C. Stallcup, Ph.D.,
Harvard University, 1980.

Michael W. Vannier, M.D.,
University of Kentucky, 1976.
(See Department of Radiology.)

Assistant Professors (Clinical)

Joseph W. Eades, M.D.,
Washington University, 1960.
(Jewish Hospital)

George H. Zografakis, M.D.,
State University of New York,
Upstate, 1959.

Instructor

John J. Iacobucci, M.D.,
University of Michigan, 1982.

Instructors (Clinical)

David A. Caplin, M.D., University
of Cincinnati, 1975. (Jewish
Hospital)

Bruce I. White, M.D., Washington
University, 1964. (Jewish Hospital)

Robert A. Young, M.D., Ohio
State University, 1978.

DIVISION OF UROLOGIC SURGERY

Head of Division

William J. Catalona, M.D., Yale
University, 1968.

Professor

Charles B. Manley, Jr., M.D.,
University of Missouri, 1958. (See
Department of Pediatrics.)

Professor Emeritus (Clinical)

Morris Abrams, M.D., University
of Illinois, 1937. (Jewish Hospital)

Professor (Clinical)

Robert K. Royce, M.D.,
Washington University, 1942.

Associate Professor

Ralph V. Clayman, M.D.,
University of California, San Diego,
1973. (See Department of
Radiology.)

Research Associate Professor

Timothy L. Ratliff, Ph.D.,
University of Arkansas, 1977.
(Jewish Hospital)

Associate Professors (Clinical)

William T. Bowles, M.D.,
Stanford University, 1955.

M. Richard Carlin, M.D., Yale
University, 1947.

Assistant Professors

Gerald L. Andriole, Jr., M.D.,
Jefferson Medical College, 1978.

Louis R. Kavoussi, M.D., State
University of New York at Buffalo,
1983.

Research Assistant Professor

Franz U. Steinberg, M.D.,
University of Berne, 1938. (See
Department of Medicine.)

Assistant Professors (Clinical)

Lawrence M. Aronberg, M.D.,
Washington University, 1936.
(Jewish Hospital)

James G. Bucy, M.D.,
Northwestern University, 1962.

Richard P. Parsons, M.D.,
Washington University, 1958.

Instructor

M'Liss A. Hudson, M.D., Univer-
sity of Texas, Houston, 1982.

Instructors (Clinical)

Saul Klein, M.D., Syracuse
University, 1959. (Jewish Hospital)

Thomas Lyles, M.D., Washington
University, 1975. (Jewish Hospital)

Neal Neuman, M.D., St. Louis
University, 1971. (Jewish Hospital)

Enrique P. Perinetti, M.D.,
National University of Cuyo,
Argentina, 1968.

Courtney Shands III, M.D.,
Vanderbilt University, 1982.

Herbert Sunshine, M.D.,
Washington University, 1954.
(Jewish Hospital)

***TEACHING AND
RESEARCH DIVISIONS***



DIVISION OF BIOSTATISTICS

The Division of Biostatistics is a medical school-wide facility that engages in teaching, research, and biostatistical consultation activities. A course given in the first trimester of the first year, Introduction to Biostatistics, affords a basis for understanding quantitative assessment in biology and medicine, and prepares the student for critical evaluation of reports in the medical literature. Interested students may pursue more intensive studies through electives offered by the Division. At the initiative of other departments, the Division also offers additional short courses in biostatistics. The Division participates actively in both pre- and post-doctoral training. In addition to the core research program of the Division, its research activities include collaborative projects with various departments of the School. Biostatistical consultation represents a major activity of the Division, providing expertise in both theoretical and applied areas.

FIRST YEAR

Introduction to Biostatistics

This introduction to the principles and methods of biostatistics emphasizes the concepts of statistical methodology and the appropriate design of clinical research projects as being essential to the proper application and interpretation of statistical methods and to a critical evaluation of the medical literature. Elementary statistical techniques illustrating the use of statistical principles in experimental and clinical research are discussed. Clinical summaries often precede the biostatistical lectures, highlighting the relevance of certain statistical principles. Small group discussions are also organized on prechosen topics to better prepare the students in evaluating published medical reports. *Drs. Schechtman and Spitznagel*

ELECTIVES

Applied Biostatistics: A Seminar Elective

This elective is intended for students who have completed a basic biostatistics course and who want to increase their understanding of contemporary statistical techniques, particularly those commonly applied in clinical research. Students are expected to participate in the analysis and critique of studies appearing in the medical literature. The emphasis is on the appropriateness of the statistical techniques and underlying rationale rather than on mathematical details of the techniques. Both basic (e.g., t tests, chi-squared tests, correlation, regression) and more advanced multivariate techniques (e.g., multiple regression, discriminant analysis, analysis of variance) are covered during the seminar. Pre- and post-doctoral students in Biostatistics are required to take this course.

Mr. Miller and Staff

Genetic Epidemiology: A Research Elective

After being introduced to current approaches in Genetic Epidemiology, interested students are supervised on research projects dealing with methodological developments as well as analysis of real data. Topics to be covered include: resolution of cultural and biological inheritance, with emphasis on multivariate associations and temporal trends; detection of major gene effects, with emphasis on pleiotropy and genetic heterogeneity; and linkage analysis and gene mapping. Pre- and post-doctoral students in genetic epidemiology are required to take this course.

Dr. Rao and Staff

RESEARCH

Research activities of the Division span a wide range of topics dealing with a number of disorders of considerable public health importance, providing research opportunities at both theoretical and applied levels. Several research projects involve close interaction and collaboration with a number of research groups at the Medical Center. The present core research program of the Division deals with genetic epidemiology, especially as it relates to cardiovascular disease. A number of theoretical and applied problems are addressed, including: nature-nurture resolution and identification of the genetic basis of risk factors such as lipids, lipoproteins, apolipoproteins, obesity, blood pressure, sex hormones, and glucose tolerance; exploration of temporal trends in the degree of genetic and environmental effects; and multivariate associations among multiple risk factors. Timely theoretical issues are also addressed, such as the sampling of families through patients, and statistical properties of methods of data analysis. Present collaborative research projects include: a coordinating center for drug trials in neuromuscular diseases, especially Duchenne Dystrophy; studies in psychiatric epidemiology; studies of the epidemiology of falls, hip fracture, and osteoporosis; Centers for the study of diabetes and Alzheimer's disease; AIDS; a SCOR project involving several laboratory and clinical research protocols on ischemic heart disease; three epidemiological research projects developing methods for increasing public awareness and utilization of measures which are known to decrease the likelihood of developing heart disease, and for encouraging behaviors which will improve prognosis following a heart attack; and epidemiological genetics and family studies of mental disorders, including schizophrenia and alcoholism.

BIOSTATISTICAL CONSULTATION

The Division provides consultation in a wide range of areas including the statistical design of experiments and clinical trials, protocol development, data base management, analysis of data, and interpretation of results. Some of the areas of special strength and expertise include cardiovascular biostatistics,

computing, and statistical packages. The Division is well equipped to provide assistance at the stage of preparing grant applications, including careful discus-

sions of study design, sample size calculations, randomization schemes, computer resources, and data analysis.

Faculty

Professor and Director

Dabeeru C. Rao, Ph.D., Indian Statistical Institute, 1971. (See Departments of Psychiatry and Genetics.)

Professors

J. Philip Miller, A.B., Washington University, 1965.

John P. Rice, Ph.D., Washington University, 1975. (See Department of Psychiatry.)

Stanley Sawyer, Ph.D., California Institute of Technology, 1964. (Also Faculty of Arts and Sciences)

Edward L. Spitznagel, Jr., Ph.D., University of Chicago, 1965. (Also Faculty of Arts and Sciences)

Reimut Wette, D.Sc., University of Heidelberg, 1955.

Assistant Professor Emeritus

Barbara B. Hixon, B.S., University of Illinois, 1941.

Assistant Professors

Mae Gordon, Ph.D., University of Wisconsin, 1978. (See Department of Ophthalmology and Visual Sciences.)

Curtis A. Parvin, Ph.D., University of Minnesota, 1980. (See Departments of Pathology and Medicine.)

Michael A. Province, Ph.D., Washington University, 1987.

Kenneth B. Schechtman, Ph.D., Washington University, 1978. (See Department of Medicine.)

George P. Vogler, Ph.D., University of Colorado, Boulder, 1985.

Research Assistant Professor

Ingrid B. Borecki, Ph.D., University of Hawaii, 1981.

Research Instructors

Cynthia Arfken, Ph.D., Yale University, 1985.

Treva K. Rice, Ph.D., University of Colorado, Boulder, 1987.

INSTITUTE FOR BIOMEDICAL COMPUTING

The Institute for Biomedical Computing is an inter-school organization which spans computing research activities at both the School of Medicine and the School of Engineering and Applied Science. The Institute was formed from two research laboratory components, the Biomedical Computer Laboratory (BCL) and the Computer Systems Laboratory (CSL), which have close ties with the departments of Computer Science and Electrical Engineering, as well as to most departments in the School of Medicine. Two new components include the Medical Informatics Group and the Center for Molecular Design.

The BCL emphasizes the development of computer hardware and software systems for use in the solution of research problems in biomedicine. Several systems now in clinical use have seen a progression from exploratory pilot studies, through major development projects, to public availability through commercial distribution. In general, BCL focuses on applications which require strong coupling of the computer to its environment for digital signal processing and quantitative biomedical imaging. Such applications employ computers and microprocessors in conjunction with specialized hardware designed and built locally. Many applications have been addressed by bringing signals from hospital wards and research laboratories to BCL or

more frequently by taking the computers to investigators' laboratories or patients' bedsides.

The central theme of the CSL program is the development of tools for building specialized computer systems for challenging applications, and the construction of high-performance systems using these tools. The emergence of design and fabrication technologies for Very-Large-Scale Integrated (VLSI) circuits over the last several years has been a major stimulus to the CSL program. Current research is focused on the development of theory and derivative computer-aided design tools for the specification and construction of highly parallel computer systems. Current projects include the design of Image Manipulation Modules (IMM), a family of modules that efficiently stores, displays and processes digitized images with up to 128 million samples, organized as 1-2-3- or 4-dimensional image arrays; and the extension of IMM with arrays of transputers.

The Medical Informatics Group (MIG) has been formed to promote the application of information science to research and clinical activities; and to provide pre- and post-doctoral training spanning computer science and various disciplines of biomedicine.

The Center for Molecular Design (CMD) provides a core facility and set of research activities to promote collaborative research in the development and application of modern mathematical, computational, and graphics tools to problems in molecular science. It has evolved from a long-term collabora-

tion between CSL, Computer Science, and Pharmacology in the area of drug design, and seeks to provide a base for broadened industrial collaboration and stronger interactions with other departments at Washington University.

The overall purpose of the Institute for Biomedical Computing is to foster the development and application of advanced computing and engineering technologies to problems in biomedical science. In addition to its activities in collaborative research, the Institute serves as a focal point for interdisciplinary teaching and student research in areas not ordinarily included in conventional curricula.

BMed 582. Biophysical Measurements

(Same as EE 582)

Specific variables measured in life-science research and in clinical medicine such as force, displacement, pressure, biopotentials, ion and gas concentration, flows, etc., are examined and techniques for converting them to electrical signals are discussed. Prerequisites: EE 482 or equivalent, elementary electromagnetic theory. Credit 3 units. *Prof. Shipton*

BMed 693. Physical and Mathematical Principles of Tracer Kinetics

Topics in the theoretical foundations of tracer-kinetic methods include differential equations for conservation of tracer mass, applications of elementary linear systems theory, stochastic and compartmental models, methods of accounting for tracer recirculation, and methods of data processing. *Dr. Larson*

Research Opportunities

Research activities of the Institute for Biomedical Computing span a wide range from basic biological science and clinical research to topics in biomedical engineering, signal processing, computer architectures, and integrated circuit design. Many research projects of the Institute involve collaboration with researchers in the basic sciences and clinical depart-

ments of the School of Medicine, or in the Departments of Computer Science and Electrical Engineering of the School of Engineering and Applied Science. Additional collaborations take place through the interdepartmental program in Biomedical Engineering.

Current emphasis in the core research program of the Biomedical Computer Laboratory is on quantitative biomedical imaging, which includes: modeling of biological phenomena as image sources; transduction processes; instrumentation characteristics; data analysis strategies for extraction of information from images; algorithms for image construction and analysis; tissue characterization via quantitative ultrasonic imaging; and development of a distributed facility for image presentation, analysis, and quantification.

Present collaborative projects in BCL include research in: 1) the pathogenesis, treatment, and sequelae of ischemic heart disease; 2) the development of methods for precise, three-dimensional dose computations in radiation treatment planning; 3) the non-invasive delineation of pharmacology, blood flow, and metabolism in the brain; 4) the development of algorithms for computational light-microscopic optical sectioning; 5) the application of advanced image analysis methods to electron-microscopic autoradiography; 6) the improvement of positron-emission tomography systems employing photon time-of-flight information; 7) the development of a image-analysis methods for physical mapping of DNA; and 8) the pathophysiology of glaucoma employing retinal imaging for regional blood-flow estimation.

The core research project of the Computer Systems Laboratory is development of techniques for designing very-large-scale integrated computer systems (VLSI) specialized for biomedical applications requiring unusual computing capability. Collaborative application projects include support of BCL projects as well as other collaborations in the areas



of drug design, molecular graphics and modeling, and auditory physiology.

The design of modular computer systems with many interconnected processors, and their application to biomedical problems of interest throughout the Medical Center, is a continuing area of research.

MIG offers special opportunities to trainees to participate in and help develop new areas of interdisciplinary research. Areas of current research interest include topics in biomedical modeling, interactive data-bases, and expert systems, applied to diabetes management, oncology, genetics, and blood bank scheduling.

Research opportunities in CMD center on algorithm development in molecular modeling, data analysis and presentation in molecular comparisons, interpretation of NMR information, three-dimensional quantitative structure-active relationships, predictions of secondary protein structure and the protein folding problem. *Drs. Frisse, Marshall, Molnar, and Thomas*



Faculty

Professor and Director, and Director of CSL

Charles E. Molnar, Sc.D., Massachusetts Institute of Technology, 1966. (See Department of Cell Biology and Physiology.) (Also School of Engineering and Applied Science)

Professor and Director of Center for Molecular Design

Garland R. Marshall, Ph.D., Rockefeller University, 1966. (See Department of Pharmacology.)

Associate Professor and Associate Director, and Director of BCL

Lewis J. Thomas, Jr., M.D., Washington University, 1957. (See Departments of Anesthesiology and Cell Biology and Physiology.) (Also School of Engineering and Applied Science)

Associate Professor and Associate Director of BCL

G. James Blaine III, D.Sc., Washington University, 1974. (See Department of Radiology.) (Also School of Engineering and Applied Science)

Associate Professor and Associate Director of CSL

Frederick U. Rosenberger, D.Sc., New York University 1969. (Also School of Engineering and Applied Science)

Assistant Professor and Director of the Medical Informatics Group

Mark E. Frisse, M.D., Washington University, 1978. (See Department of Medicine.)

Assistant Director of BCL

Russell E. Hermes, M.S., Washington University, 1982. (Also School of Engineering and Applied Science)

Assistant Director of CSL

Gerald C. Johns, B.S., Washington University, 1966.

Professor Emeritus

Harold W. Shipton, C.Eng., Shrewsbury Technical College, 1949. (Also School of Engineering and Applied Science)

Professors

R. Martin Arthur, Ph.D., University of Pennsylvania, 1968. (Also School of Engineering and Applied Science)

Jerome R. Cox, Jr., Sc.D., Massachusetts Institute of Technology, 1954. (See Department of Cell Biology and Physiology.) (Also School of Engineering and Applied Science)

Seymour V. Pollack, M.S., Brooklyn Polytechnic Institute, 1960. (Also School of Engineering and Applied Sciences)

Donald L. Snyder, Ph.D., Massachusetts Institute of Technology, 1966. (Also School of Engineering and Applied Science)

Research Professor

Kenneth B. Larson, Ph.D., Massachusetts Institute of Technology, 1964. (See Department of Neurology and Neurological Surgery.)

Associate Professor

Michael I. Miller, Ph.D., Johns Hopkins University, 1983. (Also School of Engineering and Applied Science)

Research Associate Professor

Lyndon S. Hibbard, Ph.D., Michigan State University, 1977. (See Neurology.)

Assistant Professors

Michael G. Kahn, M.D., University of California, San Diego, 1979; Ph.D., University of California, 1988. (See Department of Medicine.)

James G. McNally, Ph.D., University of Chicago, 1983. (See Department of Cell Biology and Physiology.) (Also Faculty of Arts and Sciences)

John Wai-chiu Wong, Ph.D., University of Toronto, 1978. (See Department of Radiology.)

Senior Research Associates

William M. Hart, Jr., Ph.D., University of Maryland, 1970; M.D., 1970. (See Department of Ophthalmology and Visual Sciences.)

James G. Miller, Ph.D., Washington University, 1969. (See Department of Medicine.) (Also Faculty of Arts and Sciences)

Research Associates

Thomas J. Chaney, M.S., Washington University, 1969.

Kenneth W. Clark, M.S., St. Louis University, 1967.

A. Maynard Engebretson, D.Sc., Washington University, 1970. (Also Central Institute for the Deaf)

Ting-P. Fang, D.Sc., Washington University, 1979.

Rexford L. Hill, M.S., University of Cincinnati, 1966. (See Department of Radiology.)

John W. Matthews, D.Sc., Washington University, 1980. (See Department of Radiology.)

Don A. Ronken, Ph.D., University of Washington, 1967.

HEALTH KEY MEDICAL GROUP

Health Key Medical Group is a primary care group practice providing comprehensive health services to more than 40,000 people in the St. Louis area. Previously established in 1969 as The Medical Care Group of St. Louis, Health Key's relationship with the School of Medicine has been as a teaching and research unit serving within a medical school environment. Today, the group provides care in pediatrics, internal medicine, and obstetrics/gynecology in a separate facility on the campus of the School of

Medicine, as well as in five other locations throughout the metropolitan area, including Illinois.

The practice is a site for optional programs for advanced residents in general internal medicine and general pediatrics. An elective is available for fourth-year medical students.

Health Key also is a source of data for various clinical and health services research. The practice is staffed by physicians in private practice who are members of the faculty of the School of Medicine in the Departments of Internal Medicine, Pediatrics, and Obstetrics and Gynecology.

Staff

Patricia J. Amato, M.D., Medical College of Ohio, 1982. (See Department of Pediatrics.)

Scott J. Anderson, Ph.D., Duke University, 1981; M.D., 1982. (See Department of Medicine.)

John K. Appelbaum, M.D., Washington University, 1984.

Bonnie J. Aust, M.D., University of Texas, 1979. (See Department of Pediatrics.)

Miriam J. Behar, M.D., The Johns Hopkins School of Medicine, 1981. (See Department of Pediatrics.)

Joyce E. Boehmer, M.D., University of Missouri, 1979.

Eyla G. Boies, M.D., Washington University, 1978. (See Department of Pediatrics.)

Kathleen S. Bruns, M.D., St. Louis University, 1981. (See Department of Medicine.)

James M. Corry, M.D., Washington University, 1974. (See Department of Pediatrics.)

John C. Davis, M.D., University of Michigan, 1980. (See Department of Pediatrics.)

Irl J. Don, M.D., Washington University, 1972. (See Department of Medicine.)

Charles H. Dougherty, M.D., University of Rochester School of Medicine, 1973. (See Department of Pediatrics.)

Michael J. Fedak, M.D., University of Missouri, Columbia, 1982. (See Department of Medicine.)

John P. Galgani, Jr., M.D., St. Louis University, 1982.

Nancy Z. Guggenheim, M.D., Brown University, 1980. (See Department of Medicine.)

Timothy P. Hickman, M.D., University of Missouri, Kansas City, 1980. (See Department of Pediatrics.)

Faith H. Holcombe, M.D., Washington University, 1980. (See Department of Medicine.)

William L. Johnson, M.D., University of Missouri, Columbia, 1981. (See Department of Pediatrics.)

A. Donna King, M.S.W., Washington University, 1966.

Richard L. Lazaroff, M.D., St. Louis University, 1978. (See Department of Pediatrics.)

Thomas C. McKinney, M.D.,
Washington University, 1980.
(See Department of Pediatrics.)

Susan M. Manns-Risso, M.D.,
St. Louis University, 1984. (See
Department of Medicine.)

Jerald Maslanko, M.D., Emory
University, 1975. (See Department
of Medicine.)

John H. Rice, M.D., University of
Missouri, Columbia, 1980. (See
Department of Medicine.)

Carol Robinson, M.D., University
of Missouri, 1985.

Tania L. Schmid, M.D.,
University of Mississippi, 1985.
(See Department of Medicine.)

Paul S. Simons, M.D.,
Washington University, 1967.
(See Department of Pediatrics.)

Chandrika P. Tattamangalam,
M.D., Calicut Medical College,
Calicut, India, 1973. (See Depart-
ment of Pediatrics.)

Wanda T. Terrell, M.D.,
Washington University, 1979.
(See Department of Medicine.)

Elizabeth A. Tracy, M.D., Medical
College of Wisconsin, 1986.

Stanley G. Vriezelaar, M.D.,
University of Iowa, 1981.
(See Department of Medicine.)

Kathleen Winters, M.D., Medical
University of South Carolina, 1955.
(See Department of Pediatrics.)

Patricia B. Wolff, M.D.,
University of Minnesota, 1972.
(See Department of Pediatrics.)

THE IRENE WALTER JOHNSON INSTITUTE OF REHABILITATION

The teaching of rehabilitation is conducted by various allied health and medical specialty professionals. The Irene Walter Johnson Institute of Rehabilitation provides the physical rehabilitation services for Barnes and Children's hospitals. Services range from acute rehabilitation to services with industry and include programs for children and adults. The Institute services a wide variety of acute and chronic disabilities.

BEAUMONT-MAY INSTITUTE OF NEUROLOGY

The Beaumont-May Institute of Neurology was established in 1955 by gifts from the Louis D. Beaumont Foundation, Mrs. Charles M. Rice, and Morton J. May. It is the purpose of the institute to foster basic and clinical research in neurology, with special reference to defects in the structure of the nerve cell which occasion important neurological disorders having a high incidence of prolonged disability.

Acting Director

W. Thomas Thach, Jr., M.D.,
Harvard Medical School, 1959.
(See Departments of Anatomy and
Neurobiology and Neurology and
Neurological Surgery.)

Director of Milliken Hand Rehabilitation Center

Paul M. Weeks, M.D.,
University of North Carolina, 1958.
(See Department of Surgery.)

Director of the Cardiac Rehabilitation Center

Ali A. Ehsani, M.D., Tehran
University, 1956. (See Department
of Medicine.)

Co-Director of Orthopedic Center for Upper Extremity Rehabilitation

Paul R. Manske, M.D.,
Washington University, 1964.
(See Department of Surgery.)



GRADUATE TRAINING

DIVISION OF BIOLOGY AND BIOMEDICAL SCIENCES

The Division of Biology and Biomedical Sciences, organized in 1973, is a consortium of eight university departments which together provide interdisciplinary training for Ph.D. students. This unique organization was formed because of the realization that research and training in modern biology transcend the limits of departmental structure. The faculty consists of members of seven preclinical departments in the School of Medicine--Anatomy and Neurobiology, Biochemistry and Molecular Biophysics, Cell Biology and Physiology, Genetics, Molecular Microbiology, Pathology, and Pharmacology--and of the Department of Biology in the School of Arts and Sciences. These 230 faculty are affiliated with one or more of six broad training programs: Cell Biology; Evolutionary and Population Biology; Immunology; Molecular Biology, Genetics and Biochemistry; Neural Sciences; and Plant Biology. Faculty in these programs take responsibility for all Divisional activities, including recruiting, admissions, advising, and research training, and in addition many Divisional courses and seminars are offered by the participating faculty.

Currently over 270 graduate students are enrolled in the Division, including 60 students pursuing both the Ph.D. and the M.D. through the Medical Scientist Training Program (see page 16). Requirements for the Ph.D. in each Divisional Program are highly flexible. They include a series of courses tailored to a student's background and interests, qualifying examinations usually taken during the second year, execution of laboratory research, and defense of a dissertation generated through original scientific investigation. Although students enter the Division through an affiliation with one of the six programs, it is possible for a student to transfer to another program as interests evolve. During the first year, advisers are appointed to assist students in selecting courses and seminars as well as to help them in choosing three laboratory rotations in which they will spend several months becoming acquainted with a particular area of scientific research. At the end of the first year, it is expected that each student will choose a research adviser, whereupon the student will be housed in one of the departments of the Division. Continued participation in both Divisional and departmental activities assures the versatility of interests developed during the first year.

Applications for admission to the Ph.D. programs of the Division are due January 1 for matriculation the following fall. Admission is based on demonstrated ability, future promise, and the number of positions currently available. Applicants should have completed undergraduate training in biology, chemistry, or physics at a high level of



scholastic achievement; such training should include courses in biology, genetics, chemistry (including analytical, organic, and physical), physics, and calculus. In exceptional cases, deficiencies in basic requirements may be made up by appropriate course selection during the first year of study. It is required that each applicant take both the aptitude and advanced tests of the Graduate Record Examination. Additional information and application for admission to the Ph.D. programs may be obtained by writing to the Office of Graduate Affairs, Box 8072, Washington University School of Medicine, 660 South Euclid Avenue, St. Louis, Missouri 63110. Students who wish to pursue both the Ph.D. and M.D. degrees must apply to the Medical Scientist Training Program (see page 16).

Students admitted to the graduate programs are guaranteed full stipend and tuition support contingent upon satisfactory performance. Currently the stipend is \$10,500 annually. For the 1989-90 academic year, the tuition and health fees for a full-time student are \$14,185 per year. This provides coverage by the Medical Center Student Health Service. The Division provides support for its Ph.D. students from several sources, including federally funded training grants provided by the National Institutes of Health. Support through such grants is subject to payback agreement and taxability provisions appropriate to the award.

It is expected that each student in a Ph.D. training program will devote full time to that endeavor. The Division will not accept students for part-time study, nor will it enroll students interested in a Master's degree.

The following graduate courses are offered by the Division of Biology and Biomedical Sciences, and they are available both to Ph.D. and M.D. students who meet the prerequisites stated for the appropriate course. Those courses particularly relevant to a given department are cross-listed under the department in this *Bulletin*. Faculty members in charge of courses and their departmental affiliations are shown at the end of each course description.

Bio 401. Vertebrate Physiology

This three credit-hour lecture series covers comparatively the integrated functional operation of the organ systems of vertebrates, exclusive of the endocrine system. Credit 3 units. *Coles (Biology)*

Bio 404. Laboratory of Neurophysiology

Neural analysis of sensory information, and organization of neural activity will be electrophysiologically studied by students to find out how some of the interesting experiments in neurophysiology are actually performed. Resting and action potentials, excitation transmission, sound- and photo-reception, analysis of human and animal sounds, and psychological phenomena will be examined. Credit 3 units. *Suga (Biology)*

Bio 405. Physiological Basis of Acoustic Communication

Lectures and seminars in hearing and acoustic signals of animals, from invertebrates to humans. Structural and functional adaptation for processing the signals for communication and echolocation are considered. Credit 2 units. *Suga (Biology)*

Bio 408. Human Evolution

The fossil evidence for human and nonhuman primate evolution. Classification and genetics in evolutionary perspectives, relations between biology and culture in ancient and modern populations. Credit 3 units. *Norconk (Biology)*

Bio 411. Phycology

A systematic treatment of the freshwater and marine algae. Emphasis primarily on morphology, physiology, taxonomy, and genetics of the major and minor algal groups. Certain aspects of recent research and present problems in phycology will be considered. Credit 4 units. *Nichols (Biology)*

Bio 412. Experimental Aquatic Biology

Studies of current research problems and research techniques devoted to aquatic flora and fauna. The course will include group or individual participation in a research problem or problems dealing with individual aquatic components of the aquatic environment or their interaction. Credit 4 units. *Nichols (Biology)*

Bio 4132. Plant Diversity

Concepts of classification and speciation emphasizing the diversity of flowering plants. Laboratory focuses on evolutionary mechanisms utilizing accepted systems of angiosperm phylogeny. A seven-week course, first in a series of four. Credit 2 units. *Lewis (Biology), Staff*

Bio 4133. Plant Molecular Biology

Discussion of molecular aspects of plant development, genetics of the organelles, host/symbiont interactions, plant genetic engineering. A seven-week course, second in a series of four, beginning in the eighth week of the semester and continuing through the fourth week of spring semester. Credit 2 units. *Beachy (Biology)*

Bio 4134. Physiology and Biochemistry of Plants

A discussion of those processes unique to plant development: seed development and germination, action and metabolism of hormones, photomorphogenesis, responses to environmental stresses. A seven-week course, third in a series of four. Credit 2 units. *Ho, Varner (Biology)*

Bio 4135. Bioenergetics

A discussion of bioenergetic processes with emphasis on photosynthesis, nitrogen fixation, and related processes. A seven-week course, last in a series of four. Credit 2 units. *Pakrasi (Biology)*

Bio 4181. Population Genetics

An introduction to the basic principles of population and ecological genetics. The mechanisms of micro-evolutionary processes are discussed, and an integrated ecological and genetic approach is used to study the adaptive nature of the evolutionary process. Credit 3 units. *Templeton (Biology)*

Bio 4182. Macroevolution

An advanced introduction to the study of macro-evolutionary patterns and processes with emphasis on the systematic methodology employed. Topics: theories of classification, phylogenetic reconstruction, testing of historical hypothesis, hierarchy theory, adaptation, extinction, speciation, developmental mechanisms of organismal evolution, biogeography. Credit 3 units. *Larson (Biology)*

Bio 419. Ecology

A survey of ecological principles underlying the spatial and temporal distribution of populations and biological communities. Credit 3 units. *Sexton (Biology)*

Bio 4201. Natural History of Vertebrates

Lectures, discussions and laboratory-field trips devoted to the analysis of the life histories of amphibians, reptiles, birds and mammals. The local fauna will be emphasized. Credit 3 units. *Sexton (Biology)*



Bio 424. Immunology

The basic molecular and cellular aspects of the vertebrate immune response, emphasizing the specificity of immune reactions, the structural and genetic basis of antibody diversity, and the cellular mechanisms involved in antigen recognition and the formation of specific immune responses. Other topics: regulation of immunity, allergy, tissue transplantation, and mechanisms of complement activation. Credit 3 units. *Fleischman (Molecular Microbiology)*

Bio 437. Laboratory on DNA Manipulation

An introduction to laboratory techniques for experimental manipulation of DNA molecules, including construction, isolation, and analysis of plasmids and bacteriophage and DNA sequencing. A molecular cloning experiment will be performed as a class project. Credit 4 units. *Landick, Staff (Biology)*

Bio 441. Problems in Developmental Biology

Some basic problems related to organismic development (such as the regulation of gene expression, cell-cell interaction, pattern formation) will be examined. Students will be introduced to each subject through lectures on both classical and modern experimental work. In-depth discussion on current approaches will be emphasized. Credit 3 units. *Kirk, Staff (Biology)*

Bio 445. Microbial Genetics

A course providing lectures and laboratory experience on: mutation, mutagenesis, and mutant isolation; bacteriophage genetics; gene transfer by transformation, transduction, and conjugation; and complementation analysis and gene regulation. Credit 4 units. *Curtiss (Biology)*

Bio 446. Biology of the Fungi

General aspects of the biology of the fungi, including their development, genetics, cell biology, metabolism, evolution, and ecology. Roles these microorganisms play in nature, research, medicine, industry, and agriculture. Selected living representative species studied in laboratory, with appropriate exercises on pure culture and isolation techniques and studies of morphology, growth, physiology, fermentation, cytology, life cycles, genetics, taxonomy, and identification procedures. Credit 3 units. *Maniotis (Biology)*

Bio 449. Microbiology

A lecture course covering the growth and regulation of both prokaryotic and eukaryotic microbes and their viruses, with emphasis on gene regulation, molecular biology, physiology and growth. Credit 3 units. *Kranz (Biology)*

Bio 450. Topics in the History of Eugenics

A research seminar in which students will carry out in-depth research projects on eugenics movements in the United States or Europe (1890-1960). Topics can include: genetic basis of eugenic theories, funding of the Eugenics Movement, connections between U.S. and other (e.g., Nazi) eugenics movements, etc. Credit 3 units. *Staff (Biology)*

Bio 451. General Biochemistry

A study of structure-function relationships as applied to carbohydrates, proteins, and lipids; intermediary metabolism of principal cellular components and general aspects of regulation. Credit 4 units. *Chilson (Biology)*

Bio 452. Biochemistry Laboratory

An experimental approach to selected biochemical problems, with primary focus on the isolation and characterization of proteins. Examples of both enzymatic and non-enzymatic proteins are studied. Credit 3 units. *Chilson (Biology)*

Bio 454. History of Genetics

A seminar dealing with selected topics in the history of genetics, focusing largely on the period since 1900. The first part of the seminar (weeks 1-7) will be devoted to exploration of specific topics (with primary and secondary source readings) such as: the background development of Mendel's work, cytology (1860-1930); the biometrical movement, heredity, and evolution (1860-1900); the rediscovery of Mendel, the chromosome theory and the Morgan school; Mendelism and Darwinism (1900-1940); biochemical genetics, molecular genetics, and the Eugenics Movement (1890-1940). The second part of the course will be devoted to presentation and discussion of student research papers. Credit 3 units. *Allen (Biology)*

Bio 487, 488. Undergraduate Teaching

Exceptional undergraduates may serve as teaching assistants for laboratory and/or discussion sections in departmental courses. Normally, 2 or 3 credits are given per semester for teaching activity, subject to the approval of the course instructor and the Department. Credit for teaching may not be counted toward fulfilling biology degree requirements. Students who are asked to teach, or those who apply and are accepted by a course instructor, should fill out an application form to be obtained from the Biology Department office. Credit 2 or 3 units. Must be taken Credit/No Credit only. *Staff (Biology)*

Bio 493. Seminar in Advanced Biology

This seminar will deal with topics which tend to cut across disciplinary lines within Biology. Topics, staff, and prerequisites will vary from semester to semester and will be announced during the prior preregistration period. Credit to be arranged. *Staff (Biology)*

Bio 500. Independent Work

Prerequisite: junior standing and permission of the sponsor and the Department. Credit to be determined in each case. Maximum of 6 units may be applied toward upper division credits required for the major. If the work is to be submitted for honors, further requirements are a B+ average in biology courses, a B+ average in related subjects required for a biology major, a B+ average overall, and registration for 3 units in each of 2 semesters; an honors thesis must be prepared. Credit/No Credit only. *Staff (Biology)*

Bio 501. Human Anatomy

Study of the gross structure of the human body primarily by dissection. Consent of the instructor required. Credit 6 units. *Conroy (Anatomy/Neurobiology), Phillips-Conroy, Nemeth*

Bio 502. General Physiology

This course applies the fundamental physiological mechanisms of cell biology to the functions of the major organ systems of the body, namely, the cardiovascular, renal, respiratory, gastrointestinal, and endocrine systems. The course is intended primarily for first-year medical students. Credit 6 units. *Rovainen, Wilkinson, Staff (Cell Biology/Physiology)*

Bio 504. Environmental Pathology

Lectures and directed discussion sessions dealing with selected topics in environmental pathology. Emphasis will be placed on pathogenetic mechanisms. Topics for discussion include chemical and radiation-induced carcinogenesis, chronic lung disease associated with air pollution and the effect of environmental toxins on the peripheral and central nervous system. Credit 2 units. *Schmidt, Crouch (Pathology)*

Bio 5051. Foundations in Immunology

An in-depth introduction to immunology designed for graduate students. Topics: antibody structure and genetics, B cell recognition, T cell receptor, major histocompatibility complex, T cell recognition, regulation of the immune response, immune mediators, humoral and cellular effector mechanisms, immune control of infectious disease, immunopathology including hypersensitivity and deficiency. Credit 3 units. *Cullen (Molecular Microbiology)*

Bio 506. Microscopic Anatomy

The structure of cells, tissues, and organs is studied with regard to the functional significance of the morphological features. The laboratories consist of the study of prepared slides, of preparations of fresh tissues, and of electron micrographs. A microscope will be provided for each student. Credit 4 units. *Menton (Anatomy/Neurobiology)*

Bio 5061. Cell Biology

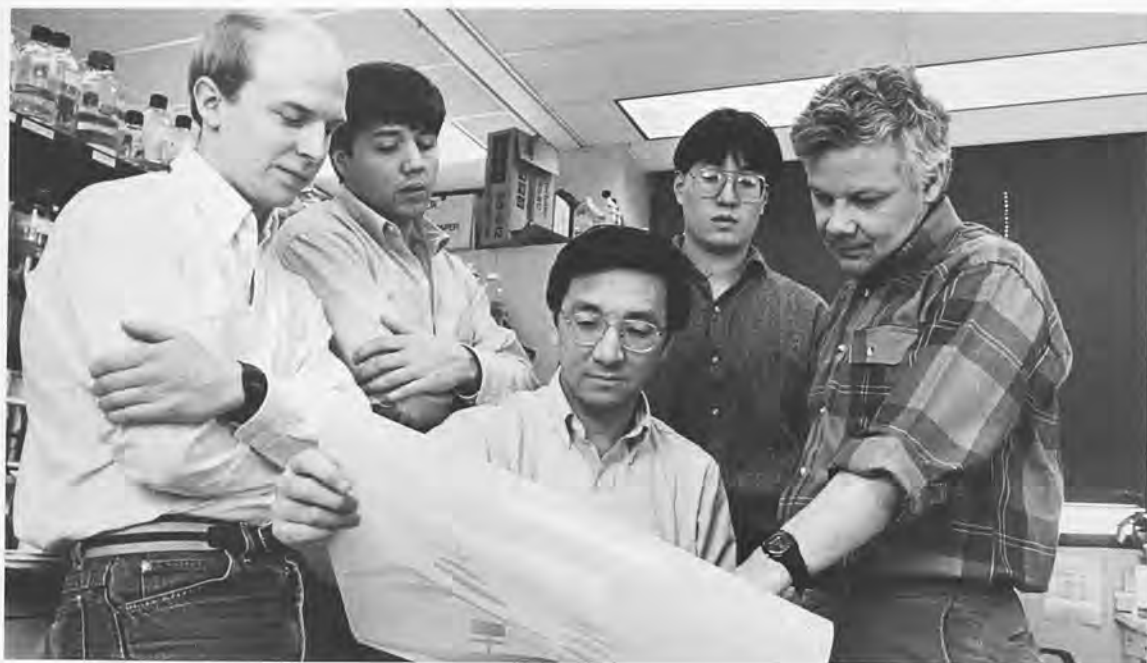
An introduction to cell biology and cell physiology. The approach is best described as biophysical and biochemical cytology. Topics: fundamentals of membrane transport, endocytosis, exocytosis and bulk membrane flow, biogenesis and function of cellular organelles, the cytoskeleton, the biology of mitosis, the extracellular matrix, and cell-cell interactions. Four lectures each week during the first medical school trimester, supplemented with demonstrations and small group conferences. Focuses on problem sets and discussion of recent and/or classical publications. (Optional—during the last 6 weeks of the course, regular meetings will be reduced to 1 hour per week for discussion of literature and preparation of a short research proposal. Any faculty member of the Cell Biology Program can serve as an advisor for the research proposal.) Credit 4 or 5 units (5 if optional tutorial is taken.) *Stahl (Cell Biology/Physiology), DeWeer*

Bio 5062. Central Questions in Cell Biology

Fundamental questions in the following areas of cell research: (1) cell-cell interactions; (2) biogenesis of organelles; (3) cytoskeleton; (4) cell physiology; (5) cell differentiation. For each section, introductory lectures and laboratory demonstrations are accompanied by discussions of experimental techniques and evaluations of the strategies employed in original papers. Credit 3 units. *Sheetz (Cell Biology/Physiology)*

Bio 5063. Molecular Cell Biology

An introduction to molecular cell biology. The approach is to explore the biophysical, biochemical, and molecular basis of cell function. Topics: fundamentals of membrane transport and receptor signaling; endocytosis, exocytosis and bulk membrane flow; biogenesis and function of cellular organelles;



the cytoskeleton; the extracellular matrix; cell-cell interactions; and the generation of cell polarity. The format will be 3 hours of lecture and 1.5 hours of discussions which focus on problem sets and discussion of recent and/or classical publications. Credit 4 units. *Stabl (Cell Biology/Physiology), Staff*

Bio 5064. Introduction to Modern Techniques of Electron Microscopy

A practical course for those students who anticipate using electron microscopy (EM) in their own research. Lectures and demonstrations will compare and contrast the various methods of sample preparation and specimen viewing currently in use, emphasizing the pros and cons of each. Students learn to evaluate works in the EM literature critically and to design meaningful EM experiments. Lab exposure will include overseeing freeze-etch techniques and individual time working with an electron microscope. Credit 3 units. *Heuser (Cell Biology/Physiology), Goodenough (Biology)*

Bio 507, 508. Pharmacology

Biological basis of drug action. The course is divided into three parts: general pharmacology, cardiovascular, neuropharmacology. Bio 508 must be taken in the spring semester to complete the course. Credit 4 units. *Covey (Pharmacology), Staff*

Bio 509, 510. Current Topics in Pharmacology

Topics of current interest presented and discussed. Critical evaluation will be made of recent articles in the scientific literature. Required of all graduate students in the department. Credit 1 unit. *Russell (Pharmacology)*

Bio 5111. Intracellular Transport of Macromolecules in Animal Cells

A discussion of the organelles responsible for the movement of macromolecules in cells. Endoplasmic reticulum, the Golgi apparatus, secretory vesicles, plasma membrane, lysosomes. Emphasis will be placed on specific recognition as a means for translocation of macromolecules. Part of the course will use the seminar format. Credit 2 units. *Stabl, Mercer, Mueckler (Cell Biology/Physiology)*

Bio 512. Selected Topics in Developmental Biology

A lecture-seminar course devoted to an in-depth analysis of a restricted number of topics of major current interest in developmental biology. A series of guest lecturers whose research is at the forefront of the area of interest will be invited to the campus to discuss their research activities with the class. These guest lectures will be supplemented by extensive readings from the current literature, lectures by local faculty, and informal discussions. Students will be evaluated on the basis of a research proposal they will prepare during the semester. Credit 2 units. *Duncan (Biology)*

Bio 5132. Cell Motility and Cytoskeleton Journal Club

Weekly presentations of recent literature and research, with each participant presenting once per semester. Opportunity for students to discuss the context, implications and future directions for research. Credit one unit. *Cooper (Cell Biology/Physiology), Staff (Biochemistry/Molecular Biophysics)*

Bio 5134. Topics in Cell Motility and Cytoskeletal Function

Selected questions concerning cell motility and the structure and function of the cytoskeleton will be explored in depth. Each student investigates a chosen topic by thorough and critical reading of the research literature presented for class discussion. Credit 2 units. *Elson (Biochemistry/Molecular Biophysics), Cooper (Cell Biology/Physiology)*

Bio 5141. Advanced Cell Biology

A course designed for advanced students in the area of cell biology and related fields. Lectures and readings stress recent advances in selected areas of eukaryotic cell biology. This year the focus is on changes in cell behavior mediated by cell-cell and cell-extracellular matrix interactions. Credit 3 units. *Goodenough (Biology), Kirk*

Bio 515, 516. General Pathology

General introduction to abnormal biology and detailed consideration of pathology of organ systems. Continuous through two semesters. Not available for credit to those holding M.D. degrees. For complete course description, see listing in the Department of Pathology. Credit 10 units for the year. *Staff (Pathology)*

Bio 5171. Medical Immunology

An introduction to basic concepts in immunology and immunopathology. Lectures will focus on antigen-antibody interactions, immunoglobulin structure and genetics, the cellular basis of the immune response and immune regulation, T cell effector mechanisms, the inflammatory response, complement, the positive and negative roles of hypersensitivity, and immune deficiency. Credit 2 or 3 units. *Unanue, Braciale (Pathology), Atkinson, Loh (Medicine)*

Bio 518, 519. Pathology Research Seminar

Graduate students, MSTP students, postdoctoral trainees, and pathology faculty will present discussions of current research from the literature, or, when appropriate, from their own laboratories. Priority for presentation given to graduate and MSTP students. Credit: those wishing to obtain credit may do so. (2 units/semester). *Baenziger (Pathology)*

Bio 5202. Microbiology and Infectious Diseases

Pathophysiology of infectious diseases taught from the standpoint of principles of pathogenicity and relevant microbial physiology and ecology. Credit 6 units. *D. Schlessinger (Molecular Microbiology)*

Bio 5221. Molecular Basis of Microbial Pathogenesis

Primarily for graduate and MSTP students, this seminar course involves discussion of current research on pathogenic microorganisms and their virulence determinants. Emphasis on new research strategies for studying the molecular mechanisms of pathogenesis and the factors controlling host-pathogen interactions. One and a half class hours per week. Credit 1 unit. *Goldman (Molecular Microbiology)*

Bio 525. Fundamental Concepts in Cell Membrane Physiology and Biophysics

A lecture course on the theoretical principles underlying the physiological properties of biological membranes. Topics include: (1) a review of aqueous solution thermodynamics and properties of electrolyte solutions; (2) diffusion and osmosis; (3) electrodiffusion, with applications to membranes; (4) membrane potentials and interfacial potentials; (5) kinetics and selectivity of ion channels; and (6) kinetics and thermodynamics of carrier-mediated transport. Credit 3 units.

De Weer (Cell Biology/Physiology)

Bio 526. Selected Topics in the Physiology and Biophysics of Cell Membranes

A seminar course devoted to in-depth analysis of selected readings. The topics to be covered include: ionophorous antibiotics and artificial membranes; movements of salt and water across organelle and cell membranes and epithelia; ion channels in biological and artificial membranes; kinetics of carrier mechanisms; and the chemistry and kinetics of the sodium pump. Credit 3 units.

De Weer (Cell Biology/Physiology)

Bio 5275. Molecular Immunology

Reading and discussion on topics in molecular immunology including molecular biology of antigen-specific receptors, lymphokines and their receptors, lymphoid cell growth control, and specific aspects of MHC genetics. Course stresses molecular approaches and how these findings relate to other nonimmunological gene systems. Credit 2 units. *Loh (Medicine), Chaplin, Korsmeyer*

Bio 5276. Cell Biology of the Immune System

A journal club format to discuss contemporary issues in the cell biology of the immune system. Discussions will focus on the use of current approaches to analyze the cellular basis of immunity. Topics will include mechanisms of cell communication, differentiation, activation, and effector activity. Credit 2 units. *Schreiber, Braciale, Allen, Thomas (Pathology)*

Bio 5281. Developmental Genetics

Genetics of developmental events, including sex determination, pattern formation, cell fate, and regulation of tissue specific genes. Emphasis will be placed on the use of genetics to investigate these phenomena in organisms such as yeast, *C. elegans*, *Drosophila*, and mouse. Credit 3 units. *Waterston (Genetics), Staff*

Bio 5291. Intracellular Mediators and Regulation of Cellular Functions

Specific examples of regulatory mechanisms including transmembrane and intracellular signal transduction. Emphasis will be placed on common intracellular mechanisms for coupling receptor-ligand interaction with biological response. Credit 3 units. *Russell (Pharmacology), Pike (Biochemistry/Molecular Biophysics), Lawrence, Nerbonne (Pharmacology)*

Bio 5301. Laboratory Computer Programming

Basic computer skills are taught, covering the PASCAL programming language and the VAX/VMS operating system. A series of problems illustrate general concepts, including files access, data structures, graphics, and signal processing. The goal of the course is to provide students with a practical grasp of programming tools to serve their research needs. Credit 3 units. *Staff (Biochemistry/Molecular Biophysics)*

Bio 531. Advanced Biochemistry

A course divided into several segments. An 11-week segment emphasizes the regulation and integration of major metabolic pathways. The second segment considers growth factors and oncogenes in detail. In

the final segment, the class divides into small "interest groups" which examine various specialized topics at the forefront of biochemistry. This section of the course requires extensive reading of the original literature and active student participation. Credit 4 units. *Frazier (Biochemistry/Molecular Biophysics)*

Bio 5321. Current Topics in Metabolic Regulation

This course will provide an in-depth study of specific examples of biochemical regulation that are currently unfolding. Common themes in regulation will be stressed in order to demonstrate how the regulation of diverse pathways can be achieved using a limited number of mechanisms. It is designed for students who have had a course in basic biochemistry and wish to achieve an integrated understanding of the system. Lectures will begin with a basic metabolic pathway or phenomenon and will briefly trace the history of research in that area to show the natural progression of science from a delineated pathway to our current understanding of the molecular basis of its regulation. Topics to be covered will include signal transduction, hormone action, regulation of gene expression, LDL and cholesterol metabolism, and will vary periodically to include new areas of research. The course will be a combination of didactic lectures (80 percent) and student discussions of current literature (20 percent). Credit 3 units.

Pike (Biochemistry/Molecular Biophysics), Rotwein, Sadler, Silbert

Bio 5341. Principles of Gene Manipulation

An introduction to the techniques of *in vitro* mutagenesis and sequencing of DNA, with hands-on laboratory experience. Designed for graduate





students nearing the completion of their rotation schedule, and especially for those who expect to enter research laboratories in which gene manipulation is not yet practiced. Credit 4 units.

Barnes (Biochemistry/Molecular Biophysics)

Bio 5351. Molecular Biology

Basic principles of prokaryotic and eukaryotic molecular biology. Credit 3 units. *Gordon (Biochemistry/Molecular Biophysics)*

Bio 536. Physical Chemistry of Macromolecules

Application of physical chemistry to the study of proteins, nucleic acids, and other natural and synthetic polymers. The thermodynamics and statistical mechanics of dilute macromolecular solutions, osmotic pressure, light scattering, viscosity, ultracentrifugation, diffusion, circular dichroism, and analysis of conformational transitions. Offered in alternate years. Credit 3 units. *Holtzer (Chemistry)*

Bio 537. Protein Chemistry and Enzyme Mechanisms

Protein chemistry; 3-dimensional protein structure and function relationships studied by crystallography and NMR. Site-directed mutagenesis, enzyme kinetics, and mechanisms. Credit 3 units. *Frieden (Biochemistry/Molecular Biophysics)*

Bio 538. Structure & Function of Cell Membranes and Surfaces

With allowance for different emphasis in different years, topics include: contemporary cell membrane models; membrane structure as revealed by electron microscopy, X-ray analysis, etc.; physical properties of lipids and membrane proteins; model membranes and their applications; permeability and active transport in mammalian and bacterial systems; cell recognition, contact inhibition, and transformation; immunological characteristics of membranes. Credit 3 units. *Frazier, R. Kornfeld (Biochemistry/Molecular Biophysics), Staff*

Bio 539. Topics in Animal Virology: The Molecular Biology of Animal and Plant Viral Diseases

RNA and DNA virus replication, shutoff of host protein biosynthesis, interferon, retroviruses with emphasis on chronic diseases (i.e., visna, AIDS), defective viruses (i.e., satellite RNA of tobacco ring spot virus, hepatitis delta virus), viruses as vectors and their possible role in preventing disease. Course consists of lectures and discussions of original papers. Credit 3 units. *S. Schlesinger, Ratner, Rice, M. Schlesinger (Molecular Microbiology), Majors (Biochemistry/Molecular Biophysics), Beachy, R. Thach (Biology)*

Bio 5404. Molecular Neurobiology

This course will cover the molecular biology and biochemistry of synaptic function, receptor recognition and regulation. Topics will include the structure and function of neurotransmitter receptors, ion channels, and the mechanisms involved in the metabolism, storage, and release of neurotransmitters. Examples will be chosen (from cholinergic, adrenergic and peptidergic systems) to illustrate applications of biochemistry and molecular biology to the analysis of these areas. Lectures, problem sets, reading and presentation of original articles. Credit 4 units. *Gottlieb (Anatomy/Neurobiology), Neural Science Staff*

Bio 5413. Topics in Molecular and Cellular Biology

A weekly journal club discussing articles of current interest in the field of molecular and cellular biology. Credit 1 unit, contingent on one presentation per year. *Staff (Biology)*

Bio 5421, 5422. Topics in Gene Expression

A weekly journal club discussing articles of current interest in the field of gene expression. One unit credit, contingent on one presentation per year. *Johnston (Genetics)*

Bio 5432. Regulatory Phenomena in Cell and Molecular Biology

Two seven-week sessions consisting of intensive lectures and discussion of current research. Topics will vary from year to year. Each session may be taken independently. Credit: 1-4 units. *S. Elgin (Biology), J. Taylor (Chemistry), M. Olson (Genetics)*

Bio 5434. Advanced Eucaryotic Molecular Genetics

Lecture/discussion of current research on gene expression (hormone activation, homeo boxes, protease families, etc.). Designed to be followed by Bio 5492. Credit 2 units. *Schlessinger (Molecular Microbiology)*

Bio 5451. Introductory Biophysical Chemistry

Introductory physical chemistry with emphasis on biochemical applications. The course offers an introduction to chemical thermodynamics, spectroscopy, hydrodynamics, kinetics and diffraction methods in the life sciences. Designed for students with no background in physical chemistry. Credit 3 units. *Elson (Biochemistry/Molecular Biophysics)*

Bio 5461. Molecular Recognition

The physical basis of molecular recognition as exemplified in biological systems examined from several viewpoints: quantum chemistry, molecular mechanics, molecular dynamics and Monte Carlo simulations, and structure-activity relations. Mole-

cular modeling and computer graphics techniques as well as current approaches in quantitative structure-activity relations based on correlation of physical properties of drug molecules, and computer-aided drug design will be reviewed. Credit 3 units.

Marshall, Covey (Pharmacology), Dammkoehler (Computer Science)

Bio 548. Nucleic Acids & Protein Biosynthesis

This course will cover fundamental aspects of the structure, biosynthesis, and function of nucleic acids and the biosynthesis of proteins. Emphasis will be placed on mechanisms involved in the biosynthetic processes and the regulation thereof. Credit 3 units. *Johnston (Genetics)*

Bio 5491. Advanced Genetics

Fundamental aspects of organismal genetics with emphasis on experimental studies that have contributed to the molecular analysis of complex biological problems. Examples drawn from bacteria, maize, yeast, nematodes and fruit flies. Credit 3 units. *Waterston (Genetics), Johnston*

Bio 5492. Human Molecular Genetics

Fundamental aspects of the structure, biosynthesis and function of nucleic acids and the biosynthesis of proteins in eukaryotes, prokaryotes, and their viruses covered. In-depth review of recent advances in human genetics. Topics include molecular basis of color vision, muscular dystrophy, tumor formation, hyperlipidemias, chromosomal translocation, sex chromosomes, gene therapy, and RFLP analysis. Designed to follow Bio 5434. Credit 2 units. *Gerhard (Genetics), Loh (Medicine)*

Bio 550. Medical Genetics

Lectures on topics including population and quantitative genetics, clinical cytogenetics, biochemical genetics and metabolic defects, counseling, and immunogenetics. Credit 2 units. *Hansen (Genetics)*

Bio 5522. Memory

A seminar course exploring experimental and theoretical approaches to understanding the biological basis of memory. Participants will read and discuss original literature with the goal of deciding what are (and are not) potentially useful avenues into this poorly understood phenomenon. Credit 3 units. *Purves (Anatomy/Neurobiology), Lichtman*

Bio 554. Neural Sciences

The course consists of a consideration of cellular aspects of the nervous system and of the neural systems of the brain and spinal cord. Credit 5 units. *Lichtman, Woolsey (Anatomy/Neurobiology)*



Bio 5562. Neural Development

An introduction to the development of the nervous system stressing principles. Students read and discuss scientific papers on major problems in this wide field. Discussion sessions analyze the strengths and weaknesses of particular experimental approaches and methods. Credit 4 units. *Lichtman, Taghert (Anatomy/Neurobiology)*

Bio 5571. Cellular Neurobiology

A survey of the basic principles of nerve cell structure and function, including quantitative analysis of voltage and chemically gated ion channels, synaptic transmission and sensory transduction. Lectures and conferences supplemented with readings of classic and contemporary papers. Credit 4 units. *Steinbach, Staff (Anatomy/Neurobiology)*

Bio 5581. Physiological Basis of Acoustic Communication

Lectures and seminars in hearing and acoustic signals of animals, from invertebrates to humans. Structural and functional adaptation for processing the signals for communication and echolocation are considered. *Suga (Biology)*

Bio 559. Nerve, Muscle, and Synapse

The ionic basis of the resting, action, and after-potentials and the mechanisms of synaptic transmission. Students will be expected to present 2 one-hour seminars based on assigned original papers. Credit 2 units. *Rovainen (Cell Biology/Physiology)*

Bio 5611. CNS Efferent Control of Sensory Function

The CNS can potentially modulate all incoming sensory information by the efferent control of primary sensory organs. Examples are the efferent vestibular and auditory systems, the efferent visual system of birds (isthmo-optic) and the efferent control of photoreceptors in *Limulus*. The neurobiology of these and other efferent systems will be studied. This course is intended for advanced graduate students. Credit 2 units. *Highstein, Steinacker (Anatomy/Neurobiology)*

Bio 5651. Neural Systems

Introduction to the structure and function of the major systems within the central nervous system. Selected topics are chosen to provide an overview of the brain with emphasis on major general concepts. Laboratories and readings of the primary literature are an integral part of this course. Credit 4 units. *Price (Anatomy/Neurobiology), Highstein, Burkhalter, Staff*

Bio 5661. Topics in Vision Research

Mechanisms of transduction and adaptation in photoreceptors; retinal circuitry and transmitters; development, structure and function of post-retinal visual areas; effects of visual deprivation. Credit 3 units. *A. Cohen (Anatomy/Neurobiology)*

Bio 567. Advanced Tutorials in Neural Sciences

Directed readings and discussions for graduate students on selected topics in advanced neural science. Topics and specific instructors to be listed at registration. Each tutorial will last for 6 weeks. Credit 1-3 units, depending on how many sessions taken. *J. Cohen (Anatomy/Neurobiology), Staff*

Bio 568. Introduction to Principles of Neuropharmacology

Basic principles of pharmacodynamics, action of drugs affecting the autonomic nervous system, receptor binding, etc. Credit 2 units. *E. Johnson (Pharmacology)*

Bio 5681. Pathogenesis of Neurologic Diseases

This course will offer an in-depth description of recent scientific advances relevant to the causes of neurologic disease. Lectures will be followed by discussions involving preclinical and clinical faculty members whose research is relevant to the disease being considered. Credit 2 units. *Snider (Neurology, Staff)*

Bio 572. Seminar in Plant Biology

Discussion of current research and concepts. Credit 2 units. *Staff (Biology)*

Bio 575. Advanced Studies in Plant Systematics

Seminars in specific topics, with main emphasis on economic botany. Other topics include anatomy, chemotaxonomy, cytology, ecotaxonomy, embryology, nomenclature, palynology, phytogeography, and bibliography. Credit 1 unit a semester. *Lewis (Biology)*

Bio 580. Seminar in Population Biology

This weekly seminar, covering topics in both population genetics and ecology, will be taken by graduate students in this program each semester. Research and literature reports will be given by staff, visitors, and graduate students. Credit 2 or 3 units. *Staff (Biology)*

Bio 581. Seminar in Techniques in Field Biology

Planning and presentation of techniques in selected areas of population biology. Credit 3 units. *Sexton (Biology)*

Bio 5821. Theoretical Population Genetics

A rigorous introduction to the theoretical basis of population genetics and evolutionary mechanisms. Quantitative genetics, population structure and molecular evolution will be investigated first, followed by an examination of how selection, population structure, and ecological factors interact in determining the evolutionary fate of a population. Credit 3 units. *Templeton (Biology)*

Bio 5822. Mathematical Ecology

The theory of the Leslie Matrix is developed with respect to population growth, colonization, demography and the evolution of life history attributes. Matrix approaches are used to study species interactions and communities. Finally, the use and limitations of optimization models in ecology are discussed. Credit 2 units. *Templeton (Biology)*

Bio 583. Plant Systematics Workshop

A series of workshops, each consisting of laboratories and tutorials: (1) monographic studies; (2) cytotaxonomy; (3) palynology; (4) microtechnique; (5) chemosystematics. Credit 1 unit. *Hoch (Biology)*

Bio 5841. Plant Population Biology

Theoretical and experimental aspects of plant population genetics and ecology. Topics include the genetic structure of native plant species, demography, life-history evolution, coevolution, and species-species interactions. Credit 3 units. *Schaal (Biology)*

Bio 585. Seminar in Floristic Taxonomy

A survey of angiosperm families, their morphology, cytology, anatomy, palynology, chemistry, and evolution. Credit 1 unit. *Hoch (Biology)*

Bio 586. Structure and Composition of Tropical Forests

An introduction to tropical forest ecology and floristics, emphasizing the unique features that make these the most complex ecosystems on earth. Focus on patterns of structural and taxonomic diversity, pollination and dispersal biology, floristic composition, and the recognition of the distinguishing features of major tropical forest plant taxa. Credit 2 units. *Gentry (Biology)*

Bio 587. Phytogeography

An introduction to the current and past geographical distributions of plants, emphasizing ecological, geological, and historical factors. Credit 3 units. *Gentry (Biology)*

Bio 588. Molecular Evolution

An investigation of the patterns and processes of molecular evolution with emphasis on proteins and nucleic acids. Topics include neutrality theory; molecular systematics; phenotypic manifestations of molecular evolutionary phenomena; evolution of transposable elements and retroviruses; evolution of multigene families; chromosomal evolution; evolution of organelle genomes. Credit 3 units. *Larson, Schaal, Templeton (Biology)*

Bio 590. Research

Credit to be arranged. *Staff (Biology)*

Bio 5911. Seminar in Biology and Biomedical Sciences

These seminars cover the recent literature in various areas not included in other courses, or in more depth than other courses. Credit to be arranged. *Staff*

Note—The number preceding the course title indicates that the course carries credit in the Graduate School of Arts and Sciences.

PROGRAM IN BIOMEDICAL ENGINEERING

This course of graduate study is designed to provide education and training for students wishing to apply principles of modern engineering and mathematics to theoretical and practical problems in biology and medicine. Students and faculty of both the School of Engineering and Applied Science and the School of Medicine participate in the program.

Every student seeking an advanced degree in engineering must be admitted to one of the participating departments of the Sever Institute of Technology, the graduate division of the School of Engineering and Applied Science. The program permits the student to earn a certificate in biomedical engineering in addition to the M.S. or D.Sc. degree in a chosen engineering field. Students who are not candidates for a degree are welcome to take courses as electives.

Graduate study plans are tailored to the individual's needs and interests, and provide essential background in the related areas of life and medical sciences. Students with diverse undergraduate backgrounds may be admitted provided they have adequate preparation and experience in mathematics and the physical sciences. Areas of specialization include sensory communications, electrocardiography, flow and diffusion in biological systems, electrophysiology, technology in health care, modeling of biological systems, engineering of artificial organs, drug concentration control, and applications of advanced computer techniques to biology and medicine. Research facilities available to the program are located in the School of Engineering and Applied Science, the School of Medicine, and the Washington University Computer Laboratories. The faculty includes representatives from the Biomedical Computer Labor-

atory; the Departments of Biological Chemistry, Cell Biology and Physiology, Preventive Medicine and Public Health, Radiology, and Anatomy and Neurobiology in the School of Medicine; and the Departments of Computer Science, Chemical, Civil, Electrical, and Mechanical Engineering in the School of Engineering and Applied Science.

Complete course listings and information about application and degree requirements may be found in the *Bulletin of the School of Engineering and Applied Science*.

Biomedical Engineering course offerings:

BMed 502. Mathematical Methods in Biophysics

BMed 547. Biological Mass and Momentum Transfer

BMed 560. Biomechanics

BMed 576. Sensory Communications

BMed 582. Biophysical Measurement

BMed 585. Ion Selective Channels in Cell Membranes

BMed 600. Research for Doctoral Dissertation

BMed 651. Science of Synthetic and Biological Polymers

BMed 660. Biomedical Applications of Small Digital Computers

BMed 693. Special Topics in Biomedical Engineering

For additional related courses, see Biomedical Computer Laboratory in this Bulletin and the *Bulletin of the School of Engineering and Applied Science*.

Faculty

Professor and Chairman

Harold W. Shipton

Professors

R. Martin Arthur
Jerome R. Cox, Jr.
John L. Kardos
James G. Miller
Charles E. Molnar
William F. Pickard
Marcus E. Raichle
Robert E. Sparks
Salvatore P. Suter
Michel M. Ter-Pogossian
Curt Thies
Reimut Wette
George I. Zahalak

Research Professor

Kenneth B. Larson

Associate Professors

Stuart B. Boxerman
William F. Holmes
Thomas R. Miller
Stanley Misler
Lewis J. Thomas, Jr.
John Wong

Senior Research Associate

Norbert S. Mason

ALLIED HEALTH PROFESSIONS

Programs are conducted by the School of Medicine in health administration, nurse anesthesia, occupational therapy, physical therapy, psychiatric epidemiology, and radiologic technology. All courses are approved by the American Medical Association or other certifying agencies, and graduates qualify for certifying examinations. For further information, write to the director or educational director listed under the particular program, 660 South Euclid Avenue, St. Louis, Missouri 63110.

HEALTH ADMINISTRATION PROGRAM

The Philosophy

The faculty of the Health Administration Program of Washington University believes that administrative personnel in health organizations require not only a solid foundation in management but also an understanding of those aspects of finance, regulation, and planning unique to the health care field. Additionally, since its inception in 1946, the program has acted on the premise that health administration students would benefit from exposure to the environment in which they will ultimately be involved. To this end the program has maintained an organizational structure consisting of a core faculty located within the School of Medicine, augmented by faculty from other schools and departments within the University, as well as affiliated institutions and agencies. This multi-

disciplinary approach enables the student to acquire not only specific management skills but an understanding of the many complexities unique to the health care sector.

Curriculum and Sequence of Study

Required courses constitute 62 percent of the course sequence for the master of health administration degree, offering vital exposure to the generic knowledge in the health administration and planning area. In addition to the elective courses available within the Health Administration Program (HAP), students may take up to 15 semester hours of graduate work in other units of Washington University. The HAP student's faculty adviser must approve the selection of courses in the student's individual curriculum. The student's previous academic work, employment experience, and ultimate performance goals enter into the individual's personalized curriculum.

As a means of furthering interdisciplinary study, up to 15 semester hours of HAP courses are open to interested graduate students from other areas of Washington University. There is also a joint M.H.A.-J.D. degree between the Health Administration Program and the School of Law, a joint M.H.A.-M.B.A. degree between the Health Administration and the graduate school of Business Administration, and a joint M.H.A.-M.I.M. degree between the Health Administration Program and the School of Technology and Information Management. Program and the graduate school of Business Administration. In addition, there are joint degrees that are under development between the Health Administration Program, the George Warren Brown School of Social Work, and the School of Architecture.



The sequence of study requires two years, each consisting of a fall and spring semester. Upon completion of the four semesters, or a total of 60 units, the student will receive a master of health administration (M.H.A.) degree conferred by Washington University. The statute of limitations is five years from the date of matriculation to complete all requirements for the M.H.A. degree. Contingent upon graduation the student has the option of pursuing a 12-month postgraduate administrative fellowship. A certificate will be awarded by Washington University School of Medicine and the affiliated residency organization upon completion of the fellowship.

Administrative Fellowship

The 12-month optional postgraduate administrative fellowship will be served in a hospital, health agency, or health organization which has been recommended and approved by the full-time faculty. This option is available only to those persons who have the M.H.A. degree conferred upon them by Washington University. The purpose of the fellowship is to provide the graduate with an opportunity to observe and practice those concepts and principles learned during the didactic on-campus exposure. The administrative fellowship is strongly recommended, as this postgraduate clinical exposure is deemed necessary for adequate professional career preparation. The fellowship is completed under the direction of a well-qualified and experienced health care administrator who is given an annual adjunct faculty appointment at Washington University School of Medicine.

The full-time faculty maintains close liaison with the administrative fellow and the preceptor. An educational plan which outlines the fellow's resident's activities for the coming year must be filed by the preceptor. The preceptor also sends two evaluation reports to the Director of HAP and shares the responsibility for recommending awarding of the certificate by Washington University School of Medicine and the fellowship site organization.

Within available resources an on-campus faculty member visits the site to meet with the preceptor and resident. HAP also sponsors an annual preceptors conference at Washington University. Interaction of these site and campus visits enables joint review of the resident's progress, as well as evaluation and refinement of the administrative fellowship experience.

Admission Requirements

Washington University's Health Administration Program is committed to nondiscriminatory practices in selection of applicants regarding race, sex, age, religion, or national origin. The faculty and staff are affirmatively committed to recruiting, enrolling, and educating students from minority groups who have the potential for graduate study.

A minimum of a bachelor's degree from an accredited university or college acceptable to Washington University School of Medicine is required, as is completion of the Graduate Record Examination (Aptitude Test) or the Graduate Management Aptitude Test. No specific undergraduate major field of study is required for admission into the program; however, introductory courses in accounting, economics, statistics (or their equivalents), and mathematics through college algebra are very strongly recommended.

Tuition per semester	\$6,800
Books and supplies (per semester)	500
Application fee (nonrefundable)	25

"B" Electives Health Administration

As a specialty, health administration (HA) looks at medical care from an institutional and organizational perspective. Rational health administration requires expert knowledge in many areas including: law, finance, planning, and organizational behavior.

The goals of this six-week elective are:

1. An overview of the specialty of health administration.
2. Firsthand contact with selected local institutions and their administrators.
3. Investigation of particular subjects of interest.

The purpose of the elective is not to make administrators out of physicians. Rather it is anticipated at the end of the six weeks that the student will be able to communicate with those persons who see medicine from an organizational viewpoint.



Faculty

Professor and Director

James O. Hepner, Ph.D.,
University of Iowa, 1964.

Professor

David A. Gee, M.H.A.,
Washington University, 1951.

Associate Professor and Associate Director

Stuart B. Boxerman, D.Sc.,
Washington University, 1970.

Associate Professor and Associate Director/Research

Robert S. Woodward, Ph.D.,
Washington University, 1972.

Associate Professors (Adjunct)

Ted Bowen, M.H.A., Washington
University, 1951.

James D. Harvey, M.H.A.,
Washington University, 1952.

David H. Hitt, M.H.A., University
of Minnesota, 1952.

Assistant Professors

Ronald E. Gribbins, Ph.D.,
University of Wisconsin, 1975.

Robert J. Hickok, M.H.A.,
Washington University, 1971. (See
Administration and Program in
Physical Therapy.)

Assistant Professors (Adjunct)

Virginia L. Drone, Ph.D.,
Washington University, 1977.

Frank S. Groner, LL.D., East
Texas Baptist College, 1946.

Boone Powell, Sr., LL.D., Baylor
University, 1958.

Mary R. Rocklage, M.H.A., St.
Louis University, 1963.

Instructor

Linda B. Cottler, Ph.D.,
Washington University, 1987.

Instructors (Adjunct)

Richard M. Abell, M.H.A.,
Washington University, 1972.

David L. Bernd, M.A., Virginia
Commonwealth University, 1973.

Edgar V. Borgenhammar, Ph.D.,
University of California, Berkeley,
1972.

Frederick L. Brown, M.H.A.,
George Washington University,
1966.

Richard W. Brown, M.H.A.,
Washington University, 1970.

Betty Ann Brucker, M.H.A., St.
Louis University, 1972.

L. Gerald Bryant, M.H.A.,
Washington University, 1968.

Keith L. Callahan, M.H.A.,
Washington University, 1977.

John T. Carson, M.H.A., Georgia
State University, 1975.

Eugene K. Cashman, Jr., M.A.,
American University, 1974.

Eric E. Chapman, J.D., George
Washington University, 1968.

Keith W. Curtis, Ph.D.,
University of Oklahoma, 1973.

Jeptha W. Dalston, Ph.D.,
University of Oklahoma, 1970.

Robert V. Deen, M.H.A.,
Washington University, 1974.

Richard C. Ellerbrake, M.H.A.,
Washington University, 1964.

John T. Farrell, M.H.A., St. Louis
University, 1973.

Thomas W. Fourqurean,
M.B.A., University of Chicago,
1949.

Max D. Francis, M.H.A.,
Washington University, 1966.

Phillip H. Goodwin, M.H.A.,
Washington University, 1968.

H. Rich Grisham, M.H.A.,
Washington University, 1973.

Dennis A. Hall, M.H.A.,
Washington University, 1973.

Howard L. Hays, M.H.A.,
Washington University, 1959.

M. James Henderson, M.H.A.,
Washington University, 1975.

Robert A. Hille, M.A., Baylor
University, 1969.

Charlotte Lehmann, M.H.A.,
Washington University, 1979.



John P. McGuire, M.H.A.,
Washington University, 1985.

Garry A. Maness, M.H.A.,
Memphis State University, 1977.

Larry L. Mathis, M.H.A.,
Washington University, 1972.

Joseph J. Neidenbach, M.H.A.,
Washington University, 1974.

John F. Norwood, M.H.A.,
Northwestern University, 1958.

D. Kirk Oglesby, Certificate in
Hospital Administration, Duke
University, 1954.

Jerry Paul, M.H.A., Washington
University, 1983.

Max H. Poll, M.H.A., University
of Minnesota, 1974.

Glenn E. Potter, M.H.A.,
Washington University, 1972.

Boone Powell, Jr., M.A.,
University of California, 1960.

Joseph H. Powell, M.H.A.,
University of Minnesota, 1955.

E. Wynn Presson, M.H.A.,
Washington University, 1965.

Jasper J. Purvis, M.H.A.,
Washington University, 1970.

Stephen C. Reynolds, M.H.A.,
Washington University, 1972.

Haynes Rice, M.H.A., University
of Chicago, 1964.

C. Edward Schwartz, M.H.A.,
Washington University, 1968.

Ponnuswamy Swamidoss,
Dr.PH., Howard University, 1981.

Charles E. Thoele, M.B.A.,
Southern Illinois University, 1976.

Robert F. Wallace, M.H.A.,
Washington University, 1974.

Dan S. Wilford, M.H.A.,
Washington University, 1966.

Gordon C. Williams, M.H.A.,
University of Chicago, 1956.



Lecturers

Lawrence I. Kahn, M.D.,
Louisiana State University, 1945.
(See Department of Pediatrics.)

Merlin E. Lickhalter, B.A.,
Massachusetts Institute of
Technology, 1957.

Robert Rubright, M.A.,
University of Wisconsin, 1958.

Darwin W. Schlag, Jr., B.S.B.A.,
Washington University, 1950.

Paul J. Schroeder, Jr., J.D.,
Washington University, 1972.

J. Stuart Showalter, J.D.,
Washington University, 1971.

Stuart D. Yoak, Ph.D.,
Washington University, 1985.

Lecturers (Adjunct)

Warren R. Betts, M.H.A., Virginia
Commonwealth University, 1959.

A. R. Black, Jr., B.S., Washington
University, 1964.

Robert E. Frank, M.H.A.,
St. Louis University, 1962.

Dean M. Hosmer, M.P.H.,
University of Michigan, 1980.

Carl T. Martinson, B.S.,
University of Kansas, 1963.

David S. Ramsey, M.H.S.A.,
University of Michigan, 1962.

Donald B. Wagner, M.H.A.,
Baylor University, 1960.

PROGRAM IN NURSE ANESTHESIA

The Department of Anesthesiology within the School of Medicine offers a program which prepares registered nurses for employment in the health care field of anesthesia. Graduates of the program are eligible for national certification, by examination through the Council on Certification of Nurse Anesthetists.

The Washington University Program in Nurse Anesthesia evolved from an anesthesia school established in 1929 and operated continuously for 54 years under the direction of Barnes Hospital.

The CRNA is a registered nurse whose advanced training enables her/him to provide a specialized nursing service. Participating as a member of the anesthesia care team, the nurse anesthetist renders anesthesia care in its entirety to surgical patients.

The curriculum covers a 24-month period, divided between didactics and clinical practicum. Educational experience is obtained at the Barnes Hospital facilities under the direction of anes-

thesiologists, certified registered nurse anesthetists, and allied health specialists. Graduates of the program have access to career opportunities throughout the United States. Applicant's credentials must include:

- (1) Current licensure as a registered nurse.
- (2) One year's experience in a critical care setting.
- (3) A Bachelor of Science Degree in Nursing, or a Bachelor's Degree which includes three humanities courses (sociology or psychology); two communications courses (English, speech, or foreign language) and five biophysical science courses (minimum 18 hours).

The program is accredited by the Council on Accreditation of Nurse Anesthesia Educational Programs/Schools and complies with its standards and guidelines.

Program specifics may be obtained from Department of Anesthesiology, Nurse Anesthesia Program, Washington University School of Medicine, Campus Box 8054, 660 South Euclid Avenue, St. Louis, Missouri 63110.

**Professor and
Head of Department of
Anesthesiology**
William D. Owens, M.D.,
University of Michigan, 1965.

Program Director
LaVerne J. Will, M.S., Southern
Illinois University, Edwardsville,
1980.

Chief Nurse Anesthetist
Robert E. Ayers, C.R.N.A.,
Barnes Hospital School of Nurse
Anesthesia, 1968;

Educational Director
Beverly A. Krause, M.S.,
Lindenwood College, 1982.



PROGRAM IN OCCUPATIONAL THERAPY

The Program in Occupational Therapy prepares students to practice occupational therapy, a clinical profession. Occupational therapy is an applied science that teaches people skills to enable them to perform the tasks of everyday living. This may involve teaching people such simple tasks as eating or getting dressed; or, it may mean teaching more difficult tasks such as learning to drive a car or developing new job skills. The goal of an occupational therapist is to help a person who has been affected by a physical or emotional disability to return to or establish a sense of normalcy in their lives. The ultimate goal of the occupational therapist is to provide people with the necessary skills to develop a sense of wholeness and independence, encouraging them to reach toward their greatest potential.

Undergraduate Program

The curriculum consists of the junior and senior years of a four-year baccalaureate degree program. Applicants for transfer must present a minimum of 60 semester hours (including required prerequisites) from an accredited college or university. In addition, students may enter after three years in a participating college or university and complete the program with two baccalaureate degrees. Three-Two arrangements must be made in advance with selected colleges and universities.

Upon completion of four academic semesters at the School of Medicine, the degree of Bachelor of Science in Occupational Therapy is conferred. Six months of supervised clinical internship is required following graduation.

Graduate Program

The curriculum consists of five semesters that are within two academic years and the intervening summer. The student must complete teaching and research practica during the five-semester program. Applicants for admission must hold a bachelor's degree or be an approved participant in a Three-Two program, and have prerequisites from an accredited college or university.

Upon completion of the five semesters including practica at the School of Medicine, the degree of Master of Science in Occupational Therapy is conferred. Six months of supervised clinical internship is required following graduation.

Tuition (graduate),	
per semester	\$6,250
Fee, Clinical Internship	700

For further information, contact the Program in Occupational Therapy, Campus Box 8066, 4567 Scott Avenue, St. Louis, Missouri 63110.
Phone: (314) 362-6911.



Faculty

Associate Professor and Elias Michael Director

M. Carolyn Baum, M.A.,
Webster College, 1979.

Instructor and Associate Director

Patricia LaVesser, M.A.,
Webster University, 1987.

Associate Professor Emeritus

Martha E. Matthew, Cert. in O.T.,
College of William and Mary, 1947.

Assistant Professors Emeriti

Garth D. Tubbs, Cert. in O.T.,
Washington University, 1955.

Ellen T. Tyson, M.A., Syracuse
University, 1950.

Elizabeth H. Withers, M.A.,
Memphis State University, 1959.

Associate Professor

C. Robert Almli, Ph.D.,
Michigan State University, 1970.

Assistant Professors

Jan Duchek-Balora, Ph.D.,
University of South Carolina, 1982.

Dorothy Edwards, Ph.D.,
Washington University, 1980.

Instructors

Joel Achtenberg, B.A.,
Washington University, 1968.

Harriet A. Backhaus, COTA,
Westminster College, 1976.

Christine Berg, M.S.,
Boston University, 1979.

Betsy Bernstrom, M.S.,
Columbia University, 1984.

Kathryn Bruns, M.A.,
Washington University, 1989.

Susan Buerkle, M.A.,
St. Louis University, 1988.

Christine Feely, Ph.D.,
Washington University, 1984.

Dennis P. Fuller, Ph.D.,
St. Louis University, 1982.

Dawn M. Holeman, M.D.,
St. Louis University, 1982.

Linda Hunt, B.S.,
University of Kansas, 1983.

Monica Perlmutter, M.A.,
Washington University, 1989.

Susan Rhomberg, B.S.,
College of St. Catherine, 1980.

Marc H. Schieber, M.D., Ph.D.,
Washington University, 1982.

Mary Seaton, B.S.,
University of Missouri, 1977.

Deborah L. Stengel, M.A.,
Webster University, 1988.

Instructors (Clinical)

Mercedes Abella
Charletta Adams
Susan Ahmad
Nancy Allen
Norma Arras
Janice Bacon
Anita Baker
Paula Terry Berg
Jeanenne Blaha
Lauri Bowles
Kim Boylan
Mary Beth Brekrus
Colleen Brewer
Luann Brown
Mary Jay Bullock
Cheryl Burton
Margaret Cochran
Al Copolillo
Monina Copuaco
Jeff Cowdry
Susan Cunningham
Sue Divine
Judy Doerr
Mary Donohue
Julie Ellis
Leigh Enge
Mary Falcetti
Susan Fine
Kim Frank
Maureen Freda
William C. Gielow
Bette Ann Gilbert
Dorothea Gilbert

Ola Glasgow
LaVerne Grady
Mary Therese Hawley
Marjorie E. Hill
Cindy Kempf
Mary Lou Kieshauer
Jeanne Kloeckner
Lisa Kohner
Sharon Kreh
James Landolt
Ann Lindberg
Mary Ann McKay
Susan McLaughlin
Patricia Melechen
Joan Merlo
Karen Miller
Kathleen Mital
Katie Mitchell
Karen Mullaney
Mary Murphy
Keri Nagib
Kathleen Okkema
Elfrieda Olney
Dottie Pennington
Mary Grace Phelan
Joanne Phillips
Daphne Piegrome
Sue Poncirolli
Julie Proctor
Julie Rosenthal
Margaret Russell
Letty Sargent
Sue Schroeder
Debby Seyer
Sophia Shuter
Clarence Sicard
Sarah Skinner
Dixie Sleight
Trudy Smith
Peggy Soebel
Barbara Sopp
Elizabeth Sullivan
Ann Swanborg
Julia Sweeney
Barbara Townsend
Phyllis Trahey
Karen Wagner
O. Gayle Wagner
Julie Walker
Pam Walters
Mary Warren
Judy Westhoff
Laura White
Terrie Winslow
Francine Woods
Pat Zielinski

PROGRAM IN PHYSICAL THERAPY

The program of instruction leading to the degree of Master of Science in Physical Therapy is an intensive two and one-half year curriculum offered at the School of Medicine. Applicants for admission must have completed either a baccalaureate degree at an accredited college or university or be eligible to participate in a combined degree program. Requirements are specific courses in English, psychology, biology, physics, chemistry, mathematics, and social sciences.

Kinesiology and pathokinesiology form the core of the curriculum. The study of these areas requires application of physical, biological, and applied science principles to normal and abnormal human movement. The basic and clinical sciences provide the foundation upon which the physical therapist can develop expertise in patient care. The goal of the curriculum is to produce practitioners who can com-

petently use the scientific approach to assess, remediate, and prevent pathokinesiological disorders.

The program provides an environment in which students are guided to acquire the requisite body of knowledge for the current and future practice of physical therapy. The faculty strives to bring scholarly knowledge to bear on the problems of the profession through research and clinical practice. Outstanding role models in the clinical and academic faculty encourage students to achieve their highest personal and professional potential.

Tuition per semester	\$5,300
Clinical Education Fee	330

Further information may be secured by direct correspondence with the Program in Physical Therapy, Campus Box 8083, 660 South Euclid Avenue, St. Louis, Missouri 63110.



Faculty

Acting Director

Susan S. Deusinger, Ph.D.,
Washington University, 1987.

Associate Professor Emeritus

Beatrice F. Schulz, M.A.,
Washington University, 1955.

Assistant Professor Emeritus

Lorraine F. Lake, Ph.D.,
Washington University, 1962.

Associate Professor

Shirley A. Sahrman, Ph.D.,
Washington University, 1973.
(See Departments of Neurology
and Neurological Surgery and Cell
Biology and Physiology.)

Visiting Associate Professor

Eugene Michels, M.A., University
of Pennsylvania, 1967.

Assistant Professors

Marybeth Brown, Ph.D.,
University of Southern California,
1984.

Robert J. Hickok, M.H.A.,
Washington University, 1971.
(See Administration and Health
Administration Program.)

Instructors

Gail W. Baudendistel, M.S.,
St. Louis University, 1977.

Ruth Clark, Ph.D., St. Louis
University, 1988.

Suzanne M. Cornbleet, M.A.,
Washington University, 1987.

Anthony Delitto, M.H.S./P.T.,
Washington University, 1983.

Ronna S. Delitto, M.H.S./P.T.,
Washington University, 1985.

Robert H. Deusinger, Ph.D.,
The University of Iowa, 1981.

Kathleen Dixon, M.Ed., Johns
Hopkins University, 1969.

Glen Johnson, M.D.,
West Virginia University, 1985.

Mary Ann Knesevich, M.D.,
Indiana University, 1981.

Wendy M. Kohrt, Ph.D.,
Arizona State University, 1986.

Mary Kate McDonnell,
M.H.S./P.T., Washington
University, 1985.

Michael Mueller, M.H.S./P.T.,
Washington University, 1985.

Barbara J. Norton, M.H.S./P.T.,
Washington University, 1984.

Richard Roettger, B.S.,
Washington University, 1962.

Vivian L. Smith, M.B.A.,
Washington University, 1988.

Jennifer S. Stith, M.S., University
of Southern California, 1978.

Janet A. Tenhula, M.H.S./P.T.,
Washington University, 1986.

Linda Van Dillen, M.H.S./P.T.,
Washington University, 1985.

Nancy B. Woolsey, M.S.,
Washington University, 1979.

Lecturers

Gene R. Brown, M.A./M.S.,
University of Iowa, 1975.

Cheryl Caldwell, B.S.,
University of Colorado, 1976.

Jay Diamond, B.S.,
Washington University, 1985.

Patricia Kohne, B.S.,
Washington University, 1985.

Susan Oliver, B.S.,
University of Kansas, 1980.

Betty Sindelar, B.S.,
Washington University, 1975.

Jennifer Weis, B.S.,
Washington University, 1982.

Instructors (Clinical)

Carmen Abbott

Steve Allen

Holly Anderson

David Apts

Dan Arnold

Robert Ashley

Michele Audet

Karen Awerkamp

Greg Bachman

Brian Badders

Debbie Baldwin

Connie Banning

Marvin Beck

Jackie Bender

Kerstin Benya

Kathy Bitzer

Susan Black

Pat Blanner

Susan Bourque

Maureen Brand

Kathy Braun

Bill Brown

Caryl Bryan

Susan Cannon

Shirley Carlson

Virginia Carlson

Blanche Carpenter

Barbara Carroll

Ann Charness

Larry Chojecki

Mary Beth Churbock

MaryPat Corrigan

Debbie Craig

Liz Dauchert

Terry Davis

Dorrie Day

Pam Dehne

Karen Delaney

Steven Dickoff

Ann E. Dinsmore

John Dooley

Lisa Dulle

Sandra Duniven

Chris Easley

Russ Eaves

Laura Elledge

Betsy Elsaesser

Marilyn Engmann

Mary Erhart

Denise Estabrooks

Kathy Fedor

Patty Finnegan

Isabel Finnell

Karinne Fish

Jean Fleming

Debra Fox

Lori Gerritsen

Marlene Gravat

Jenny Gregory

Deborah Grover

Bernie Gruzka

Debbie Guba

Cynthia Haas

Judy Hackmann

Iola Haddock

Theresa Hall

Donabelle Hansen

Linda Harr

Susan Hatfield

Stacy Heinsohn

Janet Helminoski
 Jill Hennessey
 Cathy Hinton
 Vonnie Hohensinner
 Barb Holland
 Carol Hood
 Carol Hoyer mann
 Rick Huelsing
 Gary Hunt
 Susan Johns
 Bonnie Johnson
 Dana Johnson
 Terri Johnson
 Frank Kava
 Dan Kelley
 John Kessler
 Kim Kincell
 Beth Koch-Webb
 Ed Koziattek
 Marni Kretzschmar
 Sharon Kreh
 Victor Kupfer
 Ann LaBonte
 Elaine Lampmann
 Nick Laubenthal
 Mary Liedloff
 LuAnn Lindberg
 Jane Lockett
 Jean Lofy
 Libby Lott
 Susan Love
 Ray Lucci
 Kevin McGowan
 Marsha Mahne
 David Marks
 Susan Masching
 Cheryl Mason
 Liane Meadors
 Nancy Mechesney
 Shirley Meissner

Carol Miller
 Christopher Miller
 Ellen Miller
 Jerri Miller
 Kim Miller
 Mike Miller
 Joan Mills
 Harriette Mueller
 Mike Narbecki
 Joan Niccum
 Mary Niemeyer
 Norma Olish
 Linda Olson
 Margie O'Shaughnessy
 Brian Pease
 Wayne Petereit
 Michael Pohlman
 Sue Polich
 Tammy Pudwill
 Mary Raab
 Carol Rehder
 Gina Ressler
 Jackie Rinaldo
 Chris Rinaud
 Kevin Rippey
 Paul Rockar
 Donna Roettger
 Brian Romig
 Lori Ronecker
 Jan Ross
 Erica Rouvalis
 George Rowley
 Marilyn Rubin
 Mary Rudd
 Rick Saia
 Anita Santasier
 Marion Saunders
 Raj Sawhney
 Cheryl Sazama
 Catherine Schmidt

Karen Schmidt
 Lisa Schorb
 Lisa Schraut
 Peg Schultz
 Carol Schwartz
 Gale Scott
 Sandy Shade
 Melissa Shepard
 Ann Short
 Betty Sindelar
 LuAnn Smith
 Sue Stevens
 Teri Stumbo
 Linda Swain
 Susan Swanson
 Michael R. Swedenburg
 Marcia Taeger
 Ann Thomas
 Steve Thro
 Cathy Thut
 Debra Tomacelli
 David Toennies
 Jeanne Tribou
 Sandy Trilli
 Gary Vandekamp
 Jane Warner
 Nancy Wedman
 Eric Weiskopf
 Drew Widing
 Sandra Wilson
 Susan Wright
 Margie Yanko
 Kathy Yochum
 Sherri Zack
 Mary Ziomek
 Lynn Zoellner

Miscellaneous

On January 7, 1987, the Executive Faculty acted to discontinue the Department of Preventive Medicine and Public Health. Programs and Faculty of the department are listed separately or have been assigned to other departments.

Professors Emeriti of Preventive Medicine and Public Health

C. Howe Eller (Public Health), M.D., University of Colorado, 1930; Ph.D., Johns Hopkins University, 1934.

Robert E. Shank, M.D., Washington University, 1939. (See Department of Medicine.)

Danforth Professor of Preventive Medicine and Public Health

M. Kenton King, M.D., Vanderbilt University, 1951. (See Administration and Department of Medicine.)

MASTERS PROGRAM IN PSYCHIATRIC EPIDEMIOLOGY (MPE)

This program prepares post-doctoral fellows and a select group of pre-doctoral students for an active research career in psychiatric epidemiology. Students develop basic research skills, and learn basic epidemiological methods. They study the history of development of various psychiatric diagnostic systems, the history of psychiatric epidemiology, and they become familiar with the commonly used diagnostic interviews and questionnaires. They also become familiar with computer statistical packages and become competent in data analysis.

Advanced students may be given credit for similar courses taken elsewhere. Each student selects

a mentor who is responsible for guiding him or her in research activities. Students present research findings at scholarly meetings and in journal articles and learn to write grant proposals. They serve as constructive critics of the published and submitted work of other researchers and become sensitive to ethical issues in cross-sectional and longitudinal epidemiological research. Students' time is divided between formal courses and research apprenticeships, with the greater emphasis on the latter. They participate in various stages of on-going studies: instrument development, study design, interviewer training, sample selection, data collection and management, designing and carrying out data analysis, and literature reviews.

The degree of Master of Psychiatric Epidemiology (MPE) is typically earned in two years (five semesters, including one summer).

Faculty

Professor and Director

Lee N. Robins (Sociology in Psychiatry and Faculty Arts and Sciences)

Professors

Theodore J. Cicero
(Neuropharmacology)

C. Robert Cloninger, Head,
Department of Psychiatry
(Psychiatry)

Felton J. Earls (Child Psychiatry)

John E. Helzer (Psychiatry)

Dabeeru C. Rao (Biostatistics)

Theodore Reich (Psychiatry)

John P. Rice (Mathematics in Psychiatry and Biostatistics)

Associate Professors

Andrew Heath (Psychiatry)

Collins E. Lewis (Psychiatry)

J. Philip Miller (Biostatistics)

Zila Welner (Child Psychiatry)

Research Associate Professor

Elizabeth M. Smith (Social Work
in Psychiatry)

Research Assistant Professors

Ruth L. Fischbach (Sociology in Psychiatry)

Gwendolyn G. Reich (Anthropology in Child Psychiatry)

Research Instructors

Kathleen K. Bucholz
(Epidemiology in Psychiatry)

Linda B. Cottler (Epidemiology
in Psychiatry)

Research Associate

Lawrence T. McEvoy (Psychiatry)

Instructor

Cynthia Arfken (Biostatistics)

PROGRAMS IN RADIOLOGIC TECHNOLOGY

The Department of Radiology, which has its headquarters in the Edward Mallinckrodt Institute of Radiology, offers a basic 24-month course in X-ray technology, and a 12-month postgraduate course in Radiation Therapy technology.

X-ray Technology

This two-year program is approved by the American Society of Radiologic Technologists, the American College of Radiology, the Joint Review Committee on Education in Radiologic Technology, the Council on Medical Education of the American Medical Association, and the Veterans Administration. It includes the following courses: radiation protection, professional ethics, anatomy and physiology, nursing procedures, radiation physics, medical terminology, survey of medical and surgical diseases, radiographic positioning, darkroom processing procedures, radiation therapy, radiation biology, nuclear medicine, special procedure radiography, pediatric radiography and general courses in computed tomography and magnetic resonance imaging. Course work totals approximately 760 hours.

The first six months of student training is considered a probationary period during which students will be evaluated carefully to determine their suitability for the program. Upon satisfactory completion of this probationary period, the students will begin to receive a monthly stipend of \$75 which shall continue for the next six months of training. As the student moves into the third six-month period, the stipend amount increases to \$100 per month, and rises, finally, to \$125 per month for the last six months of training.

Candidates for admission must be at least 18 years of age and present evidence of successful completion of four years of education in an accredited high school, or equivalency. Special consideration will be given to applicants who have passed college entrance examinations and to those who have earned college credits, especially in courses such as science, algebra, chemistry, and physics.

Graduate Course in Radiation Therapy Technology

The Division of Radiation Oncology offers a 12-month postgraduate course in radiation therapy technology. The course of training consists of didactic material and extensive practical experience and training in the clinical application and dosimetry procedures of radiation therapy. Approximately 1,600 new patients are treated each year. Therapy equipment available on-site includes four linear accelerators (4 MEV, 6 MEV, 20 MEV, 18/100 MEV), a cobalt unit, a superficial ortho-voltage machine, a hyperthermia suite, and three treatment planning simulators. Students obtain experience on each of the on-site therapy machines and in the affiliate training centers, as well as in the dosimetry and treatment planning area and in nursing procedures. On-site computers are used for dosimetry and treatment planning computations. The students rotate through the physics and treatment planning service in addition to attending practical demonstrations.

Director of Technical Education

Michael D. Ward, R.T., M.Ed.,
University of Missouri, St. Louis, 1987.
(See Department of Radiology.)



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*Assistant Vice Chancellor for
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*Assistant Dean in Academic
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*Assistant Vice Chancellor for
Medical Affairs and Assistant
Dean of Financial Affairs*

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*Assistant Dean for Student
Affairs, Director of Student
Financial Aid*

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*Assistant Dean for Business
Affairs*

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*Director of Library School of
Medicine*

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*Assistant Registrar in Academic
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THE MEDICAL CENTER

The Washington University Medical Center comprises seven institutions: Barnard Free Skin and Cancer Hospital, Barnes Hospital, Central Institute for the Deaf, Jewish Hospital, St. Louis Children's Hospital, the Washington University School of Dental Medicine, and the Washington University School of Medicine.

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Executive Committee of the
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¹ Part-time faculty representative to the Executive Faculty during 1988-89.

² Representing the Faculty Council during 1989-90.

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COMMITTEE ON ACADEMIC REVIEW AND PROMOTIONS II

Selected faculty members

COMMITTEE ON ACADEMIC REVIEW AND PROMOTIONS III

Selected faculty members

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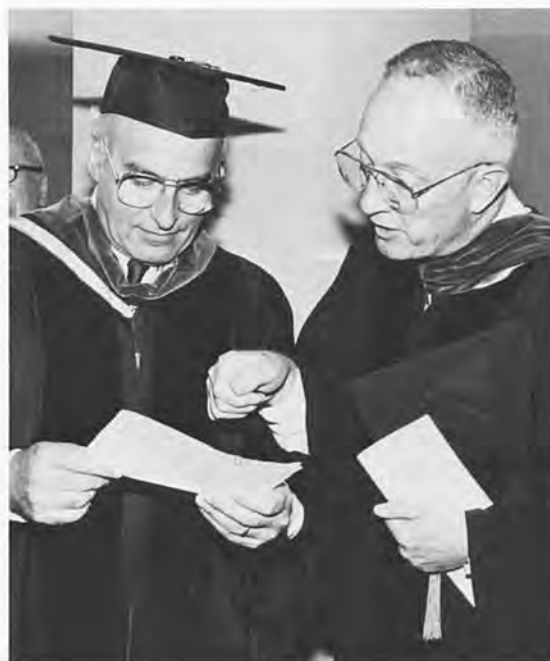
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John L. Schultz
ex officio

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DOCTOR OF MEDICINE AND DOCTOR OF PHILOSOPHY DEGREES

Medical Scientist Training Program

Graduating Class-- May 19, 1989

Apkon, Michael
Framingham, MA
B.S., Northwestern University, '82
Pediatrics
Yale-New Haven Hospital,
New Haven, CT

Arkin, Martin
Samuel Novi, MI
B.S., University of Michigan,
Ann Arbor, '80
Internal Medicine Preliminary
Faulkner Hospital, Boston, MA

Chu, Tommy Wah
Danville, IL
B.S., University of Illinois, '82
Pediatrics
Yale-New Haven Hospital,
New Haven, CT

Crowder, Charles Michael
Camden, AR
B.A., Hendrix College, '82
Internal Medicine Preliminary
Jewish Hospital, St. Louis, MO
Anesthesiology
University of Washington Affiliated
Hospital, Seattle, WA

Faust, Phyllis Lynn
Locust Valley, NY
B.A., State University College at
Potsdam, '80; B.S.,
Clarkson College of
Technology, '81
Anatomic Pathology
Barnes Hospital, St. Louis, MO

Folz, Rodney Joseph
Evansville, IN
B.S., Indiana University, '83
Internal Medicine
Duke University Medical
Center, Durham, NC

Fuhlbrigge, Robert Conrad
Toledo, OH
B.S., University of Wisconsin, '82
Pediatrics
St. Louis Children's Hospital,
St. Louis, MO

Loftus, David John
Palo Alto, CA
B.A., Pomona College, '81
Internal Medicine
Stanford University Hospital,
Stanford, CA

Mink, Jonathan Walter
St. Paul, MN
B.A., Wesleyan University, '80
Pediatrics
St. Louis Children's Hospital,
St. Louis, MO

Porter, Forbes Dennison
Worthington, OH
B.A., Washington University, '82
Pediatrics
St. Louis Children's Hospital,
St. Louis, MO

Rich, Mark Monroe
Bluffton, OH
B.A., Bethel College, '83
Internal Medicine Preliminary
Jewish Hospital, St. Louis, MO
Neurology
Johns Hopkins University,
Baltimore, MD

Selleck, Scott Brian
Seattle, WA
B.A., University of
Washington, '79
Postdoctoral Fellow
Department of Brain and
Cognitive Science,
Massachusetts Institute of
Technology, Cambridge, MA

Sweetser, David Alan
Fairfield, CA
B.S., M.S., Stanford University, '82
Pediatrics
St. Louis Children's Hospital,
St. Louis, MO

Tong, Patrick Yat-Fu
Fremont, CA
B.S., Massachusetts Institute of
Technology, '82
Internal Medicine Preliminary
Barnes Hospital, St. Louis, MO
Ophthalmology
Washington University,
St. Louis, MO

Towler, Dwight Arnold
Langdon, ND
B.A., Moorhead State
University, '83
Internal Medicine
Barnes Hospital, St. Louis, MO

Graduating Class-- December 1989

Matzuk, Martin Matthew
Colonia, NJ
B.A., University of Chicago, '82

Eighth-Year Trainees 1988-89

Hing, Andrew William
San Jose, CA
B.A., Duke University, '81

Kane, Steven A.
University Heights, OH
B.S., Miami University, '81

Seventh-Year Trainees 1988-89

Axelrod, Jeffrey David
Rochester, NY
Sc.B., Brown University, '81

Kucik, Dennis Frank
Madison, WI
B.S., University of
Wisconsin, '82

MacDonald, Margaret Russell
Corvallis, OR
B.A., Oregon State
University, '79

Masakowski, Victoria
Rose Garrett Park, MD
B.S., Washington University, '82

Quade, Bradley Joseph
New Hope, MN
B.A., MacAlester College, '82

Scott, Leland James
Red Bluff, CA
B.S., Stanford University, '82

Silverman, Neil Jerome
Los Angeles, CA
B.S., University of California,
Los Angeles, '82

Sixth-Year Trainees 1988-89

- Chesis, Paul Lee**
Tarzana, CA
B.A., University of California,
Berkeley, '83
- Dean, Andy Chen**
Elmhurst, NY
A.B., Harvard College, '83
- Diaz, Ruben**
Chattanooga, TN
B.S., Duke University, '83
- Fine, Steven Mark**
Rochester, NY
B.A., Wesleyan University, '83
- Heuckeroth, Robert Otto**
Silver Spring, MD
B.S., University of Maryland, '83
- Inhorn, Roger Charles**
Madison, WI
B.S., University of Wisconsin, '83
- Li, Dean**
Chicago, IL
B.A., University of Chicago, '83
- Silverman, Edwin Kepner**
Altoona, PA
A.B., Washington University, '83
- Sweetser, Marianne Tryphonas**
Sunnyvale, CA
B.S., M.S., Stanford University, '83

Fifth-Year Trainees 1988-89

- Carnes, Kenneth Michael**
North Hollywood, CA
B.S., Brown University, '84
- Cookson, Brad T.**
Ogden, UT
B.S., University of Utah, '83
- Green, Rebecca Paula**
Davenport, IA
B.S., University of Iowa, '83
- Hillier, David Alfred**
Stanford, CA
B.A., B.S., Swarthmore
College, '84
- Lorenz, Robinna Gail**
Okeene, OK
B.S., Stanford University, '84
- Roberts, Charlotte Justine**
Clemson, SC
B.A., Agnes Scott College, '84

- Schwab, William S., III**
New York, NY
B.F.A., School of Visual Arts, '78
- Segal, Yoav**
Tinton Falls, NJ
B.S.E., Princeton University, '84
- Sha, William Chih-Ping**
Oakbrook, IL
B.S., University of Chicago, '83
- Smith, Cynthia Mae**
Boston, MA
B.S., M.S., Stanford
University, '84
- Solomon, Joel Stuart**
Shaker Heights, OH
B.A., Johns Hopkins
University, '84
- Thio, Kwee Liu Lin**
Marietta, GA
Sc.B., Brown University, '84
- Wagman, Iris Leslie**
Raleigh, NC
A.B., Duke University, '84
- Weiner, Scott Jeffrey**
Lafayette Hill, PA
A.B., Harvard College, '84
- Zupan, Andrew A.**
Columbus, OH
B.A., Washington University, '84

Fourth-Year Trainees 1988-89

- Baker, Keith Harold**
Tequesta, FL
B.S., M.S., Emory University, '85
- Baranski, Thomas John**
Menomonee Falls, WI
B.S., University of
Wisconsin, '85
- Butman, John Anthony**
Pasadena, CA
B.S., California Institute of
Technology, '85
- Desai, Sanjay Arvind**
Greenwood, SC
B.S.E., Duke University, '85
- DiGiuseppe, Joseph Arthur**
Springfield, PA
B.S., St. Joseph's University, '85
- Fabrick, Kurt Charles**
Barrington, IL
B.A., Washington University, '85
- Faddis, Mitchell Norman**
Emporia, KS
B.S., Kansas State University, '85

- Hazen, Stanley Leon**
Cincinnati, OH
B.A., Washington University, '85
- Hershey, Andrew Dean**
Newton, IA
B.S., University of Iowa, '85
- Holland, Katherine Dana**
Pittsburgh, PA
B.S., University of Texas, '85
- Hughes, Jonathan Howard**
Marshalltown, IA
B.A., Grinnell College, '85
- Khurana, Gurjit Kaur**
Iowa City, IA
B.S., University of Iowa, '85
- Martin, David Patrick**
Kokomo, IN
B.S., Indiana University, '85
- Skelton, Timothy Patrick**
Manitowoc, WI
B.S., Massachusetts Institute of
Technology, '85
- Watson, Mark Allan**
Berkeley Heights, NJ
B.A., University of
Pennsylvania, '85
- Zempel, John Martin**
Elkhorn, WI
B.S., University of
Wisconsin, '85

Third-Year Trainees 1988-89

- Amatruda, James Francis**
Woodbridge, CT
B.A., Harvard University, '86
- Cantor, Alan Bruce**
East Northport, NY
B.A., Cornell University, '85
- Derechin, Viviana Maia**
Chicago, IL
B.S., M.S., University of
Chicago, '86
- Glaser, Paul Edward**
Euclid, OH
B.S., M.S., University of
Chicago, '86
- Goodkin, Howard Parker**
Sierra Madre, CA
B.S.E., University of
Pennsylvania, '85
- Kolodney, Michael Spencer**
Fair Lawn, NJ
S.B., Massachusetts Institute of
Technology, '86

Matheny, Cali Christine
Portales, NM
B.S., Eastern New Mexico
University, '86

Moon, Anne Marguerite
Nevada, IA
B.S., University of Iowa, '84

Pressel, David Michael
Stamford, CT
B.S., Johns Hopkins
University, '86

Ross, Theodora Suzanne
Kalamazoo, MI
B.A., Kalamazoo College, '85

Schlaggar, Bradley Lorin
Wilmette, IL
Sc.B., Brown University, '86

Simon, David Keith
Evanston, IL
B.A., Johns Hopkins University, '86

Strauss, Brian Louis
Millville, NJ
B.S., Massachusetts Institute of
Technology, '86

Westervelt, Peter
Waterville, ME
B.A., Colby College, '85

Young, Robert Lindsay
San Jose, CA
B.S., A.B., Stanford University, '86

Second-Year Trainees 1988-89

Colvin, Jennifer Susan
Towson, MD
A.B., Harvard University, '87

Filiaggi, Maria Chiara
Glen Ellyn, IL
A.B., Washington University, '87

Girard, William Philip
Westbrook, ME
B.A., Colby College, '87

Godambe, Sandip Ashok
Lisle, IL
B.A., Washington University, '87

Hanson, Robin Dale
Minneapolis, MN
B.A., Johns Hopkins
University, '85

Ho, Chris Meichung Wang
West Lafayette, IN
B.S., Purdue University, '87

Hsu, Benjamin Li-ping
Gaithersburg, MD
B.A., Harvard College, '86

Hug, Christopher
Cincinnati, OH
B.S., B.A., University of
Cincinnati, '87

Hummer, Caroline Marie
Mt. Clemens, MI
B.S., Duke University, '87

Joslin, Gregory
Jamaica Plain, MA
B.S., University of
Massachusetts, Boston, '87

Lee, Katherine Ann
Skaneateles, NY
B.A., Carleton College, '86

Leonis, Mike Anthony
Las Vegas, NV
B.A., Washington University, '87

Myers, Brenda Annette
Ft. Washington, MD
B.S., Johns Hopkins
University, '87

Niederman, Thomas M.J.
Los Angeles, CA
B.S., University of California,
Los Angeles, '87

Porter, Brenda Elaine
St. Louis, MO
B.S., Washington University, '87

Rudnick, David Alan
Champaign, IL
B.S., University of Illinois,
Urbana, '87

Silbert, Seth Cheng
Clayton, MO
B.S., Harvard University, '86

Tarle, Ivan
Novi Sad, Yugoslavia
B.S., California Institute of
Technology, '87

Veis, Deborah Jean
Skokie, IL
B.A., Princeton University, '87

Velleca, Mark Albert
New Haven, CT
B.S., Yale University, '85

Wilson, Thomas Edward
Madison, WI
B.S., University of Wisconsin,
Madison, '87

First-Year Trainees 1988-89

Aiken, Kimberly Dawn
Burlington, WI
B.S., University of
Wisconsin, '87

Altura, Rachel Allison
Whitestone, NY
B.A., Brandeis University, '88

Beck, Anita Elizabeth
Troy, OH
B.S., Massachusetts
Institute of Technology, '88

DuBois, Brian W.
San Diego, CA
B.A., University of California,
San Diego, '88

Glickman, Jonathan
Scarsdale, NY
B.S., Yale University, '87

Gudeman, Susan Jean
Knox, IN
B.S., Indiana University, '88

Lee, Stephen Luming
Westerville, OH
B.A., Washington University, '88

Mutone, Martina Francesca
Pittsburgh, PA
B.S., Notre Dame University, '88

Roberts, Charles Mortimer
Madison, WI
B.S., University of Wisconsin, '88

Sachais, Bruce S.
Florham Park, NJ
B.A., Lehigh University, '88

Solaro, Christopher Ross
Mariemont, OH
B.S., Northwestern
University, '88

Striker, Robert Todd
Cincinnati, OH
B.S., Purdue University, '88

Tykodi, Scott Simon
South Dartmouth, MA
B.A., Northwestern University, '88

Warshawsky, Ilka Ruth
West Bloomfield, MI
B.A., Brandeis University, '88

DOCTOR OF MEDICINE AND MASTER OF ARTS DEGREES

Graduating Class-- May 19, 1989

Dyer, Laura Ella

Paducah, KY
B.A., Duke University, '84
Internal Medicine Preliminary
Barnes Hospital, St. Louis, MO

Grady, R. Mark

St. Louis, MO
A.B., Princeton University, '84
Pediatrics
St. Louis Children's Hospital,
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Holland, John M.

Portland, OR
B.A., Carroll College, '84
Internal Medicine Preliminary
Jewish Hospital, St. Louis, MO

Wong, Edward C.

Honolulu, HI
B.S., University of California,
Davis, '84
Laboratory Medicine
Barnes Hospital, St. Louis, MO

Trainees 1988-89

Bischoff, James Kenneth

Los Alamitos, CA
B.S., Cornell University
Statutory Colleges, '85

Carmichael, Stanley

Thomas, Jr.
Westlake, CA
B.S., University of California,
Los Angeles, '86

Jaye, David Lawrence

Walnut Creek, CA
B.A., University of California,
San Diego, '85

Silverman, Scott Edward

Huntington Beach, CA
B.S., B.A., Pitzer College, '85

Worrall, Neil Kevin

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B.A., Johns Hopkins
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DOCTOR OF MEDICINE DEGREE

Graduating Class-- May 19, 1989

Adams, Kenneth Allen

Springfield, IL
B.S., University of Illinois,
Urbana, '85
Obstetrics and Gynecology
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Internal Medicine
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Transitional
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Ophthalmology
East Virginia Medical School,
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Pediatrics
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Radiation Oncology
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Diagnostic Radiology
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Obstetrics and Gynecology
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Obstetrics and Gynecology
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Rocky River, OH
B.A., Oberlin College, '83
Psychiatry
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University of Oklahoma
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S. Kathleen Doster

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Surgery Preliminary
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Hospitals, Minneapolis, MN
Neurology/Neurological Surgery
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Valley Stream, NY
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Internal Medicine
University of Texas Southwestern
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Internal Medicine
Temple University,
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Psychiatry
Barnes Hospital, St. Louis, MO

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Liverpool, NY
B.S., St. Lawrence University, '84
Obstetrics and Gynecology
Vanderbilt University,
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Green Bay, WI
B.S., University of Wisconsin,
Madison, '85
Surgery Preliminary
Barnes Hospital, St. Louis, MO

Fitzgerald, John Edward

Ann Arbor, MI
B.S., University of Michigan,
Ann Arbor, '85
Internal Medicine
University of Texas Southwestern
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Gillerin, Bette-Jean

Smithfield, RI
B.A., University of Rhode
Island, '83
Surgery Preliminary
Rhode Island Hospital,
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Goskowicz, Randall Louis

Wauwatosa, WI
B.S., University of Notre Dame, '85
Internal Medicine Preliminary
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Anesthesiology
University of California, San Diego,
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Pollock, LA
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Internal Medicine
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Gordon Las Vegas, NV
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General Surgery
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Conga Park, CA
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Internal Medicine
Harbor-UCLA Medical Center,
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Internal Medicine Preliminary
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USAF Hospital, Keesler AFB,
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Research Fellowship
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Internal Medicine
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College Park, '85
Surgery Preliminary
University of Washington,
Seattle, WA
Urology
University of Washington,
Seattle, WA

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Montvale, NJ
B.S., Haverford College, '83;
M.Phil., Cambridge
University, '85
Internal Medicine
Brigham and Women's
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Rohland, Barbara Marie

Withee, WI
B.S., University of Wisconsin,
Madison, '79;
M.S., University of Colorado
Health Center, '81
Psychiatry
University of Iowa Hospitals and
Clinics, Iowa City, IA

Roney, Daniel Clay

Kansas City, MO
B.A., University of Missouri,
Columbia, '85
Family Practice
University of Kansas School of
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Salvacion, Ferdinand F.

Libertyville, IL
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Transitional
U.S. Naval Hospital,
Portsmouth, VA

Samelson, Timothy Charles

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B.A., Illinois Wesleyan
University, '85
Pediatrics
University of Iowa Hospitals and
Clinics, Iowa City, IA

Schleinkofer, David Edward

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B.S., University of Indiana,
Bloomington, '85
Internal Medicine
Jewish Hospital, St. Louis, MO

Schmidt, Steven Clifford

St. Louis, MO
B.A., Washington University, '85
Surgery Preliminary
Hospital of the University of
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Schroer, William Carlton

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B.S., Purdue University, '85
Surgery Preliminary
University Hospital of Cleveland,
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Schteingart, Miriam T.

Ann Arbor, MI
B.S., University of Michigan,
Ann Arbor, '85
Internal Medicine Preliminary
University of Chicago Medical
Center, Chicago, IL
Ophthalmology
University of Illinois, Chicago, IL

Shepard, Mark Joseph

Arlington Heights, IL
B.S., University of
Notre Dame, '85
Orthopedic Surgery
Yale-New Haven Hospital,
New Haven, CT

Silverberg, Mark

Roslyn, NY
B.S., SUNY at Stony Brook, '78;
D.D.S., SUNY at Stony Brook
School of Dental Medicine, '82
Anesthesiology
Michael Reese Hospital, Chicago, IL

Singh, Raghujit

Maryland Heights, MO
A.B., Washington University, '85
Internal Medicine
Jewish Hospital, St. Louis, MO

Steinberg, Michael Paul

Oceanside, NY
B.A., University of
Pennsylvania, '85
Internal Medicine
Strong Memorial Hospital,
Rochester, NY

Strauss, Richard Scott

Rockaway, NJ
B.A., Princeton University, '85
Pediatrics
Children's Hospital,
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Summerfield, Anita Louise

Dowagiac, MI
A.B., Washington University, '85
Anatomic Pathology
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Fullerton, CA
B.A., California State University,
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Pediatrics
USAF Medical Center,
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Teckman, Jeffrey Harry

Oxford, OH
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Thompson, Brent Craig

Fargo, ND
B.A., Concordia College, '85
Diagnostic Radiology
William Beaumont Hospital,
Royal Oak, MI

Thornton, Melvin Henry II

Warrensville Heights, OH
B.A., Oberlin College, '85
Obstetrics and Gynecology
LA County-USC Medical Center,
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Tung, Jeany

Towson, MD
B.A., Washington University, '85
Internal Medicine
Francis Scott Key Medical
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Anesthesiology
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Internal Medicine
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Walker, Rebecca

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Internal Medicine Preliminary
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Ophthalmology
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Anast, William Stuart

Brookline, MA
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Apicella, Peter Lee

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Arrington, Dexter Edwin

Grambling, LA
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Benevento, William Joseph

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Brard, Gyan Singhsidhu

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Glencoe, MO
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Clancy, Cornelius Joseph

Somerset, NJ
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Huntington Station, NY
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Collum, Steven Edward

Lee's Summit, MO
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Curran, Michael Patrick

Turnersville, NJ
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Dassow, Paul Larry

Loveland, CO
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Dauer, William Todd

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DeBlicke, Timothy

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DeMichele, Angela Marie

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Dix Hills, NY
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Eastman, Paul J.

Sioux Falls, SD
B.S., University of South Dakota,
Vermillion, '85

Evans-Sanders, Leigh Virginia

Tustin, CA
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B.A., Westminster College, '62;
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Seminary, '68; M.S., University of
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Hakala, Brian Everest

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Hall, Curtis Ray

Fort Smith, AR
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Heller, Andreas Ernst

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Hsie, Tadd Taching

Mountain View, CA
B.A., University of California,
Berkeley, '86

Hsu, Shih-Wen

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O'Fallon, MO
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Jasmer, Robert Murray

Bloomfield Hills, MI
A.B., Harvard College, '86

Kahn, Barry Todd

Bergenfield, NJ
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Keeley, Francis Xavier, Jr.

Haddonfield, NJ
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Khodamoradi, Shahrdad

Mercer Island, WA
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Kibarian, Maral A.

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Kieffer, Peter Strickler

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King, Edward Dubois

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Kowalski, Lynn Debra

St. Louis, MO
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Krause, John Otto

Maryland Heights, MO
B.S., United States Air Force
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Kurnik, Ronald Ted

Manilus, NY
B.S., Syracuse University, '76;
M.S., Washington University, '77;
Sc.D., Massachusetts Institute of
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Lacy, John Griffith

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Lindsey, John Lee III

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Logsdon, Mark David

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Looby, Peter Anthony

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Movsas, Benjamin

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Hollis, NH
B.S., University of California,
Berkeley, '86

Sercombe, Randall

Reuter Bend, OR
A.B., Washington University, '86

Silverstein, Jonathan

Charles
Highland Park, IL
B.S., University of Illinois,
Urbana, '86

Slaten, Warren Keith

West Haverstraw, NY
A.B., Washington University, '86

Snyder, Bradley Jay

Prairie Village, KS
B.S., University of Kansas, '79

Speidel, Christopher

Reno, NV
A.B., Washington University, '86

Stoltz, Steven Ray

Rapid City, SD
B.S., University of California,
Berkeley, '86

Tsai, Jeanne Chun-Yu

Salem, OR
B.A., Whitman College, '86

VanDeerlin, Peter Gordon

Tustin, CA
B.A., Pomona College, '86

Vendegna, Thomas Ralph

River Grove, IL
B.S., University of Illinois,
Champaign, '86

Weber, Dean Herbert

Redwood Falls, MN
B.A., St. Olaf College, '86

Wolfer, Rebecca Sue

Spring Valley, IL
A.S., Illinois Valley Community
College, '84; B.S., University
of Illinois, Champaign, '86

Yip, Ian Kowloon,

Hong Kong
A.B., Washington University, '86

Young, Douglas G.

Sacramento, CA
B.A., University of California,
San Diego, '83

**Second-Year Class
1988-89****Antommara, Armand H.**

Valparaiso, IN
B.S., Valparaiso University, '87

Bauer, Lois Robbins

University City, MO
B.A., Carleton College, '87

Benfield, Susan Ann

Needham, MA
B.S., Yale University, '84

Blatt, Andrew Nathaniel

St. Louis, MO
B.S., Duke University, '87

Bliss, Winston Oliver

Lehigh Acres, FL
B.S., Union College, '87

Boniuk, Jonathan Daniel

St. Louis, MO
B.A., University of Pennsylvania,
Philadelphia, '86

Boris, Jeffrey Randall

Potomac, MD
B.A., Washington University, '87

Braun, Deborah Ann

St. Louis, MO
B.S., Washington University, '87

Brennan, Clare Therese

Hartland, WI
B.A., Washington University, '87

Buerger, David George

Pittsburgh, PA
B.S., Allegheny College, '87

Bui, Diemthuy Duc

New Orleans, LA
B.S., Tulane University, '87

Carlson, Curtis Bradley

Park Ridge, IL
B.A., Carleton College, '87

Connors, JoAnn

St. Charles, MO
B.S., University of Missouri,
Rolla, '87

Cordle, Richard Alan

Richmond, VA
B.A., University of Virginia, '87

Cruz, Devnandini

Little Rock, AR
B.A., Washington University, '87

desJardins, Susan Eva

Columbia, MD
B.S., Yale University, '87

De Weer, Ann Maria

St. Louis, MO
B.S., Brown University, '87

Dickson, Duncan Ross

Fargo, ND
B.A., Macalester College, '87

Donahue, John Kevin

Kansas City, MO
B.A., Washington University, '87

Donovan, Daniel Joseph

West Palm Beach, FL
B.A., Duke University, '86

Doumit, Aziz

Beirut, Lebanon
B.A., Saint Louis University, '87

Epstein, Howard Robert N.

Massapeque, NY
A.B., Washington University, '86

Fader, Darrell Jonathan

North Woodmere, NY
B.A., Washington University, '87

Ferrer, Thomas John

Farmington Hills, MI
B.S., University of Michigan,
Ann Arbor, '87

Finan, Kathleen Mary

Chicago, IL
B.S., University of Illinois,
Urbana, '87

Fogelman, Melissa Beth

North Woodmere, NY
B.A., Washington University, '87

Foster, Stephen Michael

Denver, CO
B.S., University of Colorado,
Boulder, '76; M.S.,
University of Washington, '87

Galakatos, Gregory R.

Frontenac, MO
B.S., University of Richmond, '87

Ghouri, Ahmed Faraz

Manchester, MO
Washington University

Gokhale, Ashok Vidyadhar

Middlesex, England
B.S., University of Liverpool, '79;
Ph.D., '82

Gramates, Peggy Helen

Alton, IL
B.A., Washington University, '87

Gross, Norman Warren

San Diego, CA
B.S., San Diego State
University, '84; M.A., '87

Harrington, Gary Clayton

Baltimore, MD
B.S., Howard University, '84

Hassen, Mark Amon

Tucson, AZ
B.S., University of Arizona, '81;
M.S., University of Colorado,
Boulder, '87

Heiss, Steven Gregory

Littleton, CO
B.S., Johns Hopkins University, '87

Heusel, Jonathan William

Hooper, NE
University of Nebraska, Lincoln, '87

Horne, Dale Scott

Tucson, AZ
B.A., Washington University, '82;
Ph.D., Tulane University, '87

Huizenga, Hugh Fletcher

Rochester, MN
B.A., Williams College, '84

Igel, Brian Joseph

Akron, OH
B.A., Duke University, '87

Ikeda, Alvin Kiyochi

Honolulu, HI
B.A., University of
Pennsylvania, '87

Jay, Patrick Yinkan

San Jose, CA
B.S., Stanford University, '87

Jessurun, Carlos Ruben

Aruba
B.S., Barry University, '85

Johnson, Randall Roy

Overland Park, KS
B.A., Northwestern University, '87

Kase, Evelyn Claire

Wayland, MA
B.A., Skidmore College, '85

Kaskowitz, Lawrence Steven

St. Louis, MO
A.B., Washington University, '86

Kilo, Charles John

St. Louis, MO
B.A., University of Kansas, '86

Koucky, Diane Jean

St. Louis, MO
B.S., University of Illinois,
Urbana, '87

Kraus, Madeleine Dereding

St. Louis, MO
B.A., Smith College, '84

Kuplic, James David

Sheboygan Falls, WI
B.S., Brown University, '87

Lerner, Charles Alan

Cincinnati, OH
B.S., Washington University, '86

Levy, Donald Steven

St. Louis, MO
B.A., Duke University, '87

Levy, Edward Raphael

Newton, MA
B.A., Yale University, '87

Levy, Edward Samuel

St. Louis, MO
B.A., Duke University, '87

Lipnick, Jesse August

St. Louis, MO
B.A., Brandeis University, '86

Lottick, Adam Teller

Kingston, PA
B.A., Swarthmore College, '85

Lowenthal, Robert Allen

N. Miami Beach, FL
B.S., University of Florida, '87

Lucarelli, Mark Joseph

Belleville, IL
B.A., University of Ohio,
Dayton, '87

Luker, Gary Dean

Martinsville, IN
B.S., University of Indiana,
Evansville, '87

McAtee, Scott James

Klamath Falls, OR
B.A., Washington University, '87

McCarty, Robyn Ellison

Amarillo, TX
B.S., Texas A&M University, '86

McGovern, Tristan M.

Salt Lake City, UT
B.S., University of Idaho, '81

McTague, Jerome Anthony

Springfield, MO
B.A., University of Ohio,
Toledo, '86

Mageto, Yolanda Nyaboke

Potomac, MD
B.S., Andrews University, '86

Malone, Mark Joseph

Naperville, IL
U.S., University of Chicago,
Loyola, '87

Mandal, Robert Walter

Saratoga, CA
B.S., University of California,
Davis, '87

Marshall, John David

Peoria, IL
B.S., University of Illinois,
Urbana, '87

Martucci, Elizabeth A.

Santa Monica, CA
B.S., University of Notre Dame, '87

Matsumoto, Bertram T.

Iwakuni, Japan
B.S., Stanford University, '85

Meeks, Steve Lamont

Colp, IL
B.A., Harvard University, '87

Melo, Anibal Gonsalves

Providence, RI
B.A., Rhode Island College, '82;
M.A., '87

Mormol, Jeffrey Stuart

Bexley, OH
B.S., Indiana University, '86

Newberry, Rodney David

Jerseyville, IL
B.A., Washington University, '87

Ojemann, Jeffrey George

Mercer Island, WA
B.A., Princeton University, '87

Patterson, Lee Virgil

Tulsa, OK B.A., Harvard
University, '85

Pendleton, Kimberly Dawn

Mt. Vernon, MO
B.S., Southwest Missouri State
University, '87

Piasecki, Melissa P.

Inglefield, IN
B.A., Washington University, '87

Prasad, Chandra

Oxford, MS
B.S., University of Mississippi, '87

Quackenbush, Robert Craig

Spokane, WA
B.A., Seattle Pacific University, '84

Raison, Charles Louis

Dinuba, CA
B.A., Stanford University, '81;
M.A., University of Colorado, Den-
ver, '85

Rhim, Sung-Hee

Pasadena, CA
B.S., Stanford University, '87

Rowlands, Caroline N.

Hollywood, CA
B.A., California State University,
Northridge, '87

Schmieder, Frank

West Germany
B.S., University of Maryland
College Park, '82; M.S., University
of Wisconsin, Madison, '85

Serota, Pearl

Flushing, NY
B.A., Washington University, '87

Shelton, Richard Russell

Peekskill, NY
B.S., Washington University, '87

Shepherd, Mark David

Massillon, OH
B.S., Wittenberg University, '87

Simmons, Douglas Ambrose

Hamilton, Bermuda
B.S., Yale University, '87

Simpson, Kurt Robert

Woodstock, IL
B.S., University of Illinois,
Urbana, '86

Smith, Jean Annette

California, MO
B.A., University of Missouri,
Columbia, '87

Southworth-Schmieder,

Bonnie
Potomac, MD
B.A., Oberlin College, '81

Suri, Rita Anshu

St. Louis, MO
B.A., Johns Hopkins University, '86

Swanson, Robert Gordon

Northfield, MN
B.S., Vanderbilt University, '87

Thorsett, David Andrew

Salem, OR
B.A., Colorado College, '87

Trocinski, Douglas Robert

Gresham, OR
B.S., University of Oregon,
Portland, '87

Tuggle, Tonya Denise

Gary, IN
B.A., Brown University, '87

Vaughn, Eric Turner

St. Louis, MO
B.S., University of Missouri,
St. Louis, '86

Venable, Eltaniece Trussy

Baltimore, MD
B.A., Johns Hopkins University, '86

Wong, Kenneth Honhing

Los Angeles, CA
B.S., University of Southern
California, '87

Wyatt, Jonathan Allen

Chicago, IL
B.A., Washington University, '87

Yang, Henry Poyen

Palatine, IL
B.A., Northwestern University, '87

Zamora, Rene Llenado

Quezon City, Philippines
B.S., University of Oregon, '87

**First-Year Class
1988-89****Adams, Susan E.**

Osage City, KS
B.S., University of Kansas, '77;
Ph.D., University of Kansas
Medical Center, '84

Aft-Kenigsberg, Rebecca

Chesterfield, MO
B.S., University of
Wisconsin, Madison, '78; Ph.D., '83

Antell, Andrew G.

Westport, CT
B.S., Tufts University, '86

Arcangeli, Carlos G.

Santa Monica, CA
B.S., University of California,
Los Angeles, '88

Bacharier, Leonard B.

Massapequa, NY
B.A., Johns Hopkins University, '88

Belle, Beverly A.

Brooklyn, NY
B.A., Barnard College, '85;
M.S., Columbia University, '87

Bernstein, Marc J.

Fayetteville, NY
B.A., Haverford College, '88

Bradshaw, Barton G.

Orem, UT
B.A., Harvard University, '87

Bradshaw, Joyce G.

Menlo Park, CA
B.A., Harvard University, '86

Brenner, Bruce M.

Passaic, NJ
B.S., New Jersey Institute of
Technology, '88

- Brown, Angela L.**
Sherrill, AR
B.S., Southern Methodist University, '87
- Brown, Christopher A.**
Fairfield, IL
B.S., University of Illinois, Urbana, '88
- Canaday, David H.**
Youngstown, OH
B.A., University of Pennsylvania, '88
- Chapman, Jeff T.**
Roscoe, IL
B.S., Northwestern University, '88
- Chen, Diana M.**
Rolla, MO
B.S., Washington University, '88
- Cho, Judith E.**
Apple Valley, CA
B.S., University of California, Davis, '88
- Coke, Courtney C.**
Stone Mountain, GA
B.A., University of Chicago, '88
- Colbert, Mary E.**
Carmel, IN
B.A., DePauw University, '88
- Cortland, Dawn**
St. Louis, MO
B.S., University of Wisconsin, Madison, '76;
M.S., University of California, San Francisco, '82
- Davis, Grace V.**
Greendale, St. Catherine, Jamaica
B.S., Andrews University, '88
- Densmore, Tamara L.**
Atlanta, GA
B.S., Emory University, '88
- Eitel, Janice R.**
St. Louis, MO
B.S., Bowling Green State University, '73
- Eppell, Beth Anne**
Beachwood, OH
B.S., University of Massachusetts, Boston, '87
- Fedor, Matthew**
Greenville, NC
B.S., Washington University, '88
- Finn, Gregory K.**
Sherwood, AR
B.A., Hendrix College, '88
- Fischbach, Peter S.**
St. Louis, MO
B.A., Colgate University, '87
- Frank, David R.**
Peoria, IL
B.S., Northern Illinois University, '88
- Frenchie Debra L.**
St. Louis, MO
B.A., Washington University, '84;
M.S., University of Missouri, St. Louis, '87
- Funaki, Brian S.**
Koloa, HI
B.A., Johns Hopkins University, '88
- Garcia-Ferrer, Francisco J.**
Overland Park, KS
B.S., Rockhurst College, '88
- Gomez, Carlen A.**
St. Louis, MO
B.S., University of Michigan, Ann Arbor, '88
- Gorman, Douglas S.**
Cincinnati, OH
B.S., Washington University, '88
- Griffiths, Russell H.**
Salt Lake City, UT
B.S., University of Utah, '88
- Harvey, Steven A.**
Rolla, MO
B.A., Washington University, '88
- Hay, Christine M.**
Rockville, MD
B.A., University of Virginia, '88
- Hillemeier, Peter B.**
St. Louis, MO
B.A., University of Missouri, St. Louis, '88
- Hockzema, Grant S.**
Silver Spring, MD
B.S., Calvin College, '88
- Holman, Russell L.**
Cincinnati, OH
B.A., Washington University, '88
- Horning, Neil R.**
Bristol, TN
B.A., University of Tennessee, Knoxville, '88
- Hultsch, AnneLise A.**
Columbia, MO
B.A., Washington University, '87
- Ihnat, Daniel M.**
Neshaniz, NJ
B.A., Rutgers University, '86
- Ingels, Stephen C.**
Norman, OK
B.A., Rice University, '83;
M.S., University of Wisconsin, Madison, '87
- Jacob, Dominique**
Kansas City, MO
B.A., Northwestern University, '88
- Jaeger, Jenifer L.**
Hastings-on-Hudson, NY
B.A., Washington University, '83
- Johnson, Byron W.**
Memphis, TN
B.S., Rhodes College, '88
- Johnson, Donald R.**
Oxford, OH
B.A., Ohio State University, '87
- Kasemsap, Pachavit**
Las Cruces, NM
B.S., New Mexico State University, '88
- Kaufman, Richard M.**
Pittsburgh, PA
B.S., Duke University, '88
- Kays, Bradley W.**
Long Beach, CA
B.A., University of California, San Diego, '87
- Kolar, Brian J.**
Orange, CA
B.A., Occidental College, '88
- Kortebein, Patrick M.**
Milwaukee, WI
B.S., University of California, Los Angeles, '85
- Kunes, Margaret L.**
Phoenix, AZ
B.A., University of California, San Diego, '87
- Kwa, Julie A.**
New City, NY
B.S., Yale University, '88
- Lai, James Z.**
Tulsa, OK
B.S., Southern Methodist University, '88
- Lederman, Eric D.**
Pittsford, NY
B.S., Yale University, '88
- Lee, Jon G.**
Sacramento, CA
B.A., University of California, Berkeley, '87

Leibowitz, Matthew

Northbrook, IL
A.B., Harvard University, '88

Leimbach, Mark E.

Aurora, IL
B.S., University of Michigan,
Ann Arbor, '88

Levy, Armond L.

Emmaus, PA
B.S., Washington University, '86

Liakos, Photine

DeKalb, IL
B.S., Washington University, '88

Lingelbach, Jane M.

New Berlin, WI
B.A., Washington University, '87

Lum, Sharon

St. Louis, MO
B.A., Harvard University, '88

McCrae, Paula C.

Philadelphia, PA
B.A., Cornell University
Endowed College, '85

McGhee, Janet G.

Manhattan, KS
B.A., Kansas State University, '85

McGuire, Mary C.

Mt. Prospect, IL
B.S., University of Michigan,
Ann Arbor, '87

McHaney, Mark B.

Fresno, CA
B.A., California State
University, Fresno, '88

Malden, Eric S.

Potomac, MD
B.A., University of Rochester, '88

Miller, Jeffrey S.

Dane, WI
B.A., Northwestern University, '88

Misir, Nahrayshwar D.

Pasadena, TX
B.S., University of Houston, '88

Morris, Jonathan A.

Ann Arbor, MI
B.S., University of Michigan,
Ann Arbor, '88

Newell, Astrid M.

Eugene, OR
B.S., Lewis and Clark College, '85

Novoa, Louis J.

Los Angeles, CA
B.A., Brown University, '85

Ornstein, David K.

Stanford, CA
B.S., University of
Pennsylvania, '88

Pappano, Dante A.

Kent, CT
B.A., Washington University, '88

Pfanstiel, Ingrid R.

Tulsa, OK
B.S., Oklahoma State
University, '88

Pollack, Kurt M.

Carmel, IN
B.A., DePauw University, '88

Pustilnik, Stephen M.

Philadelphia, PA
B.A., University of
Pennsylvania, '88

Rankin, Denise M.

Mentor, OH
B.A., Case Western Reserve
University, '88

Redmond, Gregory S.

Olathe, KS
B.S., Stanford University, '88

Reikes, Sanford T.

Marinez, CA
B.S., University of California,
Riverside, '88

Reinhart, Robert D.

Palmerton, PA
B.S., Pennsylvania State
University, '88

Ritter, David W.

Florissant, MO
B.S., Washington University, '88

Rothman, Mark C.

Creve Coeur, MO
B.S., Washington University, '88

Sample, Madison

Chicago, IL
B.A., Harvard University, '87

Sasseen, Brett M.

St. Louis, MO
B.A., University of
Pennsylvania, '88

Schwartz, Jonathan D.

New York, NY
B.A., Brown University, '86

Semin, Michele D.

Kilgore, NE
B.S., Washington University, '88

Sheafor, Douglas H.

Baltimore, MD
B.S., Duke University, '88

Shibuya, Robert B.

Los Altos Hills, CA
B.A., University of California,
Berkeley, '87

Shin, John C.

Orland Park, IL
B.S., Stanford University, '85

Skop, Brian P.

Miami, FL
B.S., Duke University, '88

Soares, Robert L.

Merritt Island, FL
B.A., Brown University, '87;
M.A., '88

Sola, James B.

Tacoma, WA
B.S., Carroll College, '88

Spector, Michelle

Nanuet, NY
B.S., Duke University, '88

Spraul, Joseph W.

St. Louis, MO
B.A., Rice University, '88

Stein, Steven J.

Lancaster, CA
B.S., University of California,
Irvine, '88

Stevermer, James J.

Easton, MN
B.S., Michigan State University, '83

Stokes, Sam

Memphis, TN
B.A., Lake Forest College, '88

Stosor, Valentina

Chicago Heights, IL
B.S., University of Illinois,
Urbana, '88

Suggs, Adrienne H.

Florissant, MO
B.A., Washington University, '88

Szwerc, Michael F.

Mahwah, NJ
B.A., Washington University, '88

Terrill, Stephen G.

Moran, KS
B.S., Pittsburg State University, '88

Thomas, Thomas V.

Mission Hills, KS
B.A., Boston University, '88

Thompson, Paul A.

Chico, CA
B.S., University of California,
Davis, '88

Treptow, Craig L.
Rangely, CO
B.S., Kearney State College, '88

Vinci, Lisa M.
Palos Park, IL
B.S., University of Illinois,
Urbana, '88

Waggoner, Darrel
Nashville, TN
B.A., Saint Louis University, '88

Weber, Clifford K.
Lutherville, MD
B.A., Washington University, '87;
M.A., Johns Hopkins University, '86

Zelazny, Anthony M.
Joliet, IL
B.A., University of Illinois,
Urbana, '88



SUMMARY OF STUDENTS IN THE SCHOOL OF MEDICINE 1988-89

Doctor of Medicine and Doctor of Philosophy Degrees

Graduating Class	16
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 Benedict, William W. 76
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SCHOOLS OF WASHINGTON UNIVERSITY

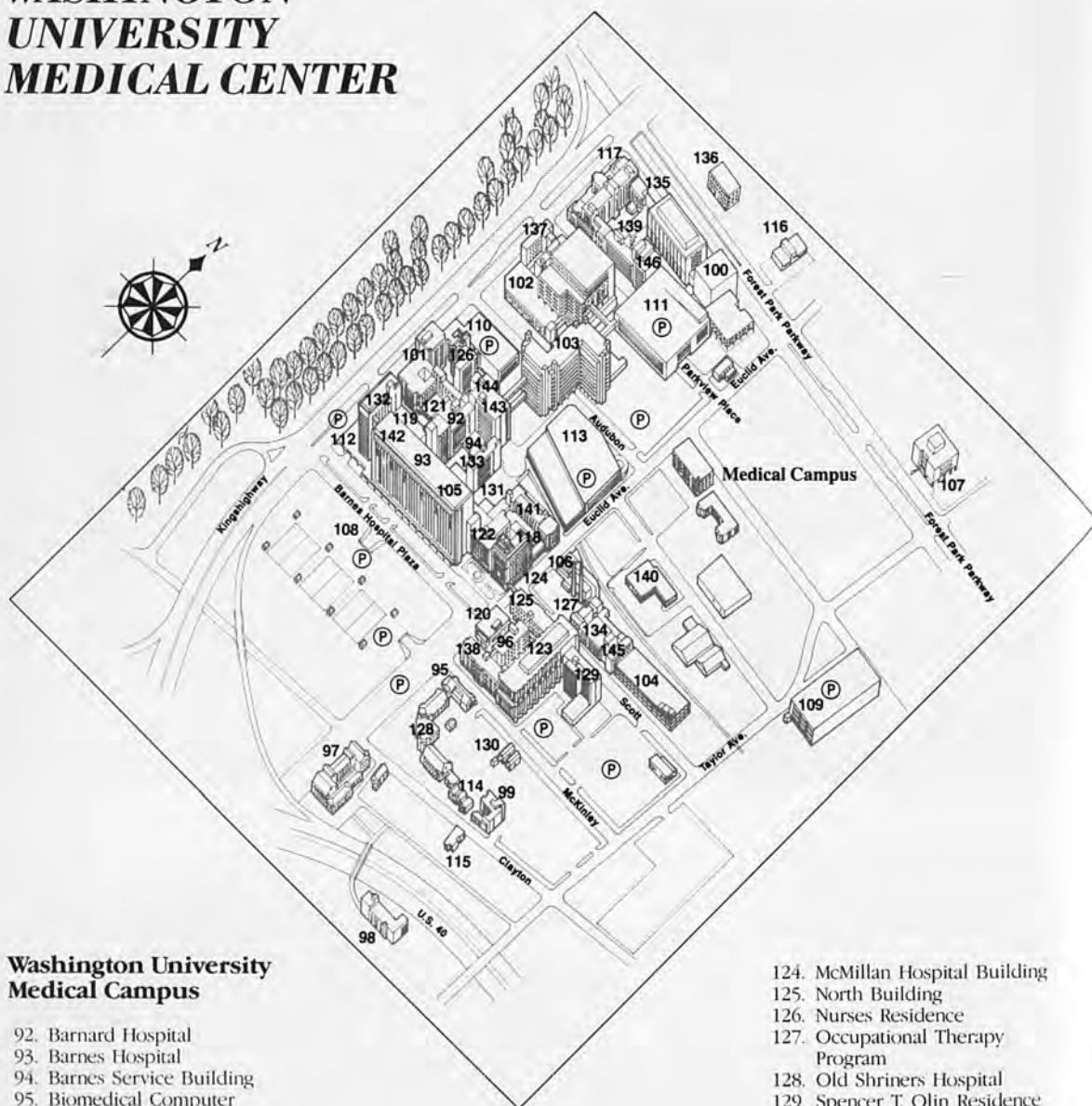
All schools are located at One Brookings Drive, St. Louis, Missouri 63130, except Medicine (660 South Euclid Avenue, 63110) and Dental Medicine (4559 Scott Avenue, 63110). A University-sponsored shuttle bus travels between the main campus and the medical/dental campus every 20 minutes.

The College of Arts and Sciences
The Graduate School of Arts and Sciences
The School of Engineering and Applied Sciences
The Sever Institute of Technology
The School of Technology and Information Management
The School of Architecture

The School of Business and Public Administration
The Graduate School of Business Administration
The School of Fine Arts
The School of Social Work
The School of Law
The School of Medicine
The School of Dental Medicine
University College
The Summer School

The information that appears in this Bulletin was compiled in the spring of 1989. It is current as of March 15, 1989.

WASHINGTON UNIVERSITY MEDICAL CENTER

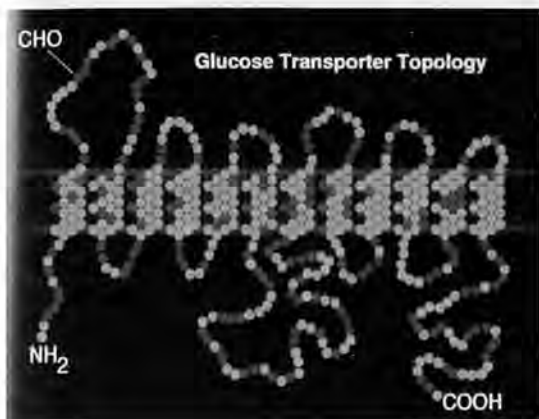


Washington University Medical Campus

- 92. Barnard Hospital
- 93. Barnes Hospital
- 94. Barnes Service Building
- 95. Biomedical Computer Laboratory
- 96. Cancer Research Building
- 97. Central Institute for the Deaf (CID)
- 98. CID Clinic/Research Building
- 99. CID Residence Hall
- 100. Central Medical Building
- 101. Children's Hospital (original building)
- 102. Children's Hospital (new)
- 103. Clinical Sciences Research Building
- 104. East Building
- 105. East Pavilion
- 106. Euclid Power Plant
- 107. 4511 Forest Park Medical Center
- 108. Garage, Barnes Plaza
- 109. Garage, Barnes (Taylor Ave.)
- 110. Garage, Children's Hospital

- 111. Garage, Jewish Hospital
- 112. Garage, Queeny Tower
- 113. Garage, School of Medicine
- 114. Health Administration
- 115. Internal Auditors Building
- 116. Internal Medicine Business Office
- 117. Jewish Hospital
- 118. Irene Walter Johnson Institute of Rehabilitation
- 119. Rand Johnson Building
- 120. Library
- 121. Mallinckrodt Institute of Radiology
- 122. Maternity Hospital
- 123. McDonnell Science Building

- 124. McMillan Hospital Building
- 125. North Building
- 126. Nurses Residence
- 127. Occupational Therapy Program
- 128. Old Shriners Hospital
- 129. Spencer T. Olin Residence Hall
- 130. Personnel Office, School of Medicine
- 131. Peters Building
- 132. Queeny Tower
- 133. Renard Hospital
- 134. School of Dental Medicine
- 135. Shoenberg Pavilion
- 136. Shoenberg Research Building
- 137. Shoenberg School of Nursing
- 138. South Building
- 139. Steinberg Building
- 140. Storz Building—Medical Care Group
- 141. West Building
- 142. West Pavilion
- 143. Wohl Clinic
- 144. Wohl Hospital Building
- 145. Wohl Research Laboratory
- 146. Yalem Research Building



The glucose transporter is a membrane glycoprotein that carries glucose from the blood into cells. A defect in this protein could hypothetically cause diabetes by raising blood glucose levels. Pictured at left is a model for the two-dimensional topology of the glucose transporter in the red blood cell plasma membrane. The protein is believed to weave in and out of the lipid bilayer in the form of 12 alpha-helical peptide domains. On the right is a hypothetical model showing how five of these helices might cluster together to form a water-filled pore through the membrane. Glucose is believed to transverse the fatty acyl core of the lipid bilayer through this aqueous tunnel. (From research by Mike Mueckler, Ph.D., Assistant Professor of Cell Biology.)

(continued from inside front cover)

of somatomedin in plasma as an index of growth hormone activity. These methods resulted in major advances in the diagnosis of human growth disorders, such as dwarfism and acromegaly. He also made major contributions to our understanding of adrenal steroid transport and diabetes mellitus.

Dr. Kipnis' contributions have allowed us to understand how insulin affects protein and carbohydrate regulation. He has helped to elucidate the determinants of insulin secretion and action in various tissues; the effects of insulin on cellular protein and lipid metabolism; the mechanisms of insulin resistance in obesity, acromegaly and pregnancy; and the role of alanine, substrate and fuel mobilization in neonatal and childhood hypoglycemia and other clinical conditions. He also helped develop techniques for the measurement of polypeptide hormones and cyclic nucleotides. Dr. Kipnis is chairman of the Department of Medicine and, like Dr. Daughaday, is a member of the National Academy of Sciences.

The School of Medicine is internationally acclaimed for the training it provides individuals in the basic sciences and in the care of patients with diabetes. Training is provided through several comprehensive programs coordinated among the Departments of Medicine, Pediatrics, Pathology, Ophthalmology, Pharmacology, Cell Biology, and Psychiatry. These programs involve more than 35 full-time senior faculty members and more than 100 students and postdoctoral trainees actively involved in molecular and cellular biology, biochemistry, immunology, genetics, human physiology and pathophysiology.

Many of these researchers are internationally renowned. They include M. Alan Permutt, M.D., known for his work on insulin biosynthesis; Philip Cryer, M.D., an expert on the response to hypoglycemia in diabetes; David James, Ph.D., who studies the transport of glucose; Peter Rotwein, M.D., who studies insulin-like

growth factors; John Holloszy, M.D., who is an expert on the physiology of exercise; Gustav Schonfeld, M.D., who is responsible for understanding the association between lipid disorders and diabetes; and Marc Hammerman, M.D., for his research on growth factors in the kidney.

Translating this new knowledge to the care of patients also is a major focus. Several thousand patients are seen each year in the Washington University Medical Center for endocrine or metabolic disorders, including more than 800 insulin-dependent diabetic children and adults who are part of several ongoing diabetes-related studies, and approximately 150 children who are being treated with recombinant human growth hormone. The Diabetes Research and Training Center — one of six such centers funded by the National Institutes of Health — is regarded as a major international research and training resource for islet transplantation, glucose transporters, growth factors, insulin biosynthesis, and clinical research. Washington University is also one of 27 medical centers across North America to participate in the Diabetes Control and Complications Trial, a 10-year prospective study funded by the National Institutes of Health that looks at the relationship of glucose control to the long-term complications of diabetes. The trial is designed to determine how effective some of the newer forms of diabetes therapy are in preventing, delaying, or reversing the diabetic complications known to affect the kidneys, nerves, eyes, heart, and blood vessels.

A major research institution, Washington University School of Medicine receives more than \$95 million annually in support of a comprehensive range of scientific investigations and, in addition to diabetes research, is recognized for contributions to the fields of radiological studies, pharmacology, cardiology, psychiatry, neurobiology, cell biology, immunology, and genetics.

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